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U. S. DEPARTMENT OF AGRICULTURE

UNITED STATES
DEPARTMENT OF AGRICULTURE
MISCELLANEOUS PUBLICATION NO. 344

Washington, D. C. July 1939

TAXONOMY OF SOME SCALE INSECTS OF THE GENUS PARLATORIA[1] ENCOUNTERED IN PLANT QUARANTINE INSPECTION WORK[1]

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INTRODUCTION

Certain scale insects of the genus *Parlatoria* have for many years been recognized as of economic significance. The frequency with which some of them are encountered on plant material coming into the United States from foreign sources suggests that the importance of the genus as a whole has greatly increased owing to the spread of its members in injurious numbers to new localities and to new plant hosts. The Department of Agriculture has only recently successfully completed an extended campaign for the eradication of one of the species infesting date palms, which established itself many years ago in the Southwestern States. Species of *Parlatoria* are recorded as serious pests of citrus groves in various parts of the world, and other species have been recorded as injurious to various horticulturally important rosaceous hosts, such as the apple, pear, and

[1] Hemiptera : Coccoidea.

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peach. It is possible, therefore, that at least some of these species may prove injurious in this country.

The following discussion attempts (1) to modify certain published, but apparently incorrect, synonymy among the species of *Parlatoria;* (2) to call attention to some new synonymy that needs recognition; (3) to increase the available knowledge on the distribution and host relationships of the species discussed; and (4) to present information and illustrations to aid in the recognition of these species.

Since the treatment is in no sense monographic, no attempt has been made to examine critically all structural characters of these insects, or to fix rigidly the limits of variation expected to occur in such structures, nor has more than the necessary incidental attention been given to the literature on the genus. Although published information on the distribution and host associations of these species has been considered, most of the information on these points that is included has come from a study of specimens in the national collection of Coccidae, many of which have accumulated from identification work.

This study has been much aided by the type and other authentic specimens of various species of *Parlatoria* which have been presented to the national collection of Coccidae in past years. In addition, special mention should be made of the loan for study, by G. F. Ferris, of type specimens of *Parlatoria cinerea*, as this loan positively cleared up confusion respecting this species.

The genus *Parlatoria* is here used in the currently accepted rather broad sense, and no attempt has been made to establish subgroups among the species discussed or to form opinions on various published proposals to place some of these species in other generic units.

It is hardly possible to place too much emphasis on the fact that the species of *Parlatoria* consistently exhibit marked minor variability in the anatomical structures which may be utilized to develop a classification that will satisfactorily differentiate the various species. Indeed, the extent of this normal variation within any one species, especially with respect to quantitative characters, such as numbers of pores, is such that it seems to be practically impossible to rely on single anatomical characters for positive recognition of a species. Details of such variation appear in the discussions under the different species, and will show the limits observed in this study; but it should be recognized that the first specimen examined by a user of this publication may fall outside the limits of variation here recorded in respect to the condition of some of its characters. On the other hand, several specimens from any one lot of material should average within these recorded limits, and it is here recommended that such a series of specimens be examined by the student wherever this is practicable.

Although the limitations of the photographic method of illustration [2] are obvious, and in some instances conspicuous, it is believed that a definite advantage results from the presentation of the various structural characteristics in their natural setting. Line drawings of anatomical characteristics, some prepared in careful detail, have already been published for most of these species.

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[2] The photographic illustrations accompanying the discussion have been prepared in the Section of Illustrations by M. L. Foubert.

STRUCTURAL CHARACTERS CONSIDERED IN THIS STUDY

EYESPOT

The eyespot, if correctly interpreted throughout all the species studied, shows differences that appear to have definite usefulness for the differentiation of some of the species. In two, *blanchardi* and *zizyphus*, it is a large, conspicuous, sclerotized area, on the surface of the derm in the case of *blanchardi* and at the apex of a prominent globular marginal lobe in the case of *zizyphus*. In all the other species it is much smaller and sometimes very obscure and possibly lacking. In two forms, *crotonis* and *proteus*, this structure, if correctly interpreted, appears as a stout spur, decidedly variable in size, that protrudes from the prosomal margin on each side in normally oriented specimens. In some of the other species the spot appears only as a tiny, flattened disk, but in some it may be a protruding structure, hemispherical to conical to short cylindrical in shape.

SPIRACLES

The spiracles themselves do not appear to possess differences in structure that are of taxonomic significance.

The anterior spiracles are regularly accompanied by multilocular disk pores. The average number of these present is reasonably consistent for any species, but the individual variation within the species is such that little taxonomic use can be made of this average condition. The number of pores observed in the course of examination of material ranged from 1 to 11.

A curious structure appears in more or less obvious association with the posterior spiracles in some of these species. It is a membranous invagination of the derm, located between each posterior spiracle and the body margin at a point varying with the species and from one-quarter to one-half of the total distance away from the spiracle. No evidence has been obtained as to the function of this structure, and it is somewhat irrational to utilize it, both on this account and because it is difficult to observe with certainty in poorly prepared specimens. At the same time, after hundreds of specimens have been examined, it seems to be as nearly constant in its presence or absence as are the spiracles themselves; and in view of the variability that exists in other usable characters, this one should certainly be utilized fully if future studies confirm the conclusions here formulated regarding its occurrence.

DUCT TUBERCLES

The duct tubercles are prominent, conical, sclerotized protuberances along the margins of the anterior body segments. They vary much in shape from flattened conical to elongate, almost cylindrical, and likewise are apt to show decided shape variation in any single specimen. At the same time the general characteristics of these tubercles seem to be reasonably consistent for any species, and they serve as supplementary characters that aid in the recognition of some of the species.

From this study these structures occur normally in clusters on each side of the body, one cluster on the margin anterior to the anterior spiracles, one directly opposite the anterior spiracles, one in

the interspace between the anterior and posterior spiracles, one opposite the posterior spiracles, and one on the segment behind these. It is assumed that the anterior cluster is located on the head, and it seems evident that the posterior cluster is on the first abdominal segment, but to avoid possible misinterpretation of the basic morphology of these insects these clusters are designated in the subsequent descriptive notes as prespiracular, anterior spiracular, intermediate, posterior spiracular, and first abdominal. Apparently this first abdominal segment is the transition point between these structures and those often designated as plates. The duct tubercles on this segment tend toward greater elongation than in the anterior clusters, and generally one or two recognizable plates are evident at the posterior corner of the segment. The condition outlined above appears to be maintained for all the species here discussed except *blanchardi* and *zizyphus*. In *blanchardi* these duct tubercles appear to be entirely lacking. In *zizyphus* the anterior groups are lacking and the remaining tubercles are much reduced in size and very short conical, while the duct opening is proportionately much larger than in the remaining species.

DORSAL TUBULAR DUCTS

Two groups of dorsal tubular ducts are here considered. One is the cluster or band of submarginal ducts which appears on each side of the body, on the abdominal segments, and which varies greatly in number of included ducts, depending on the species, but also, unfortunately, varies conspicuously within the species. As here accepted, this group of ducts embraces all these large, short tubular ones except those of the single row along the edge of the abdomen, which are clearly marginal. The numbers in a group may range from as few as 7 to more than 100. Usually the posterior ducts are largest, and the size decreases gradually anteriorly. Presumably these ducts have a definite segmental arrangement, but this is usually obscured by their apparently unrestricted distribution over the surface of the abdominal segments involved.

The second group of dorsal tubular ducts comprises those occupying the medial portions of the abdominal segments. In this discussion these ducts are designated as intermediate and median macroducts or microducts, according to their location and size. The difference between macroducts and microducts is probably purely arbitrary and in some species shows some tendency to break down through individual variation, but usually there is no difficulty in deciding whether the ducts are large enough to be classed as macroducts, such appearing as reduced copies of the large marginal and submarginal tubular ducts, or should be classed as microducts, which have the tube proper many times longer than the opening. The intermediate ducts as here defined may occur from a point between the anterior paragenital pore clusters, when these are normally oriented, to the anterior apex of the abdomen, but they most frequently appear in a cluster above the anterior paragenitals and in a row or cluster on the segment preceding this, generally at the margin of the sclerotized area normally present on the dorsum of the pygidium. Their arrangement is obviously segmental. The median ducts occur less frequently and when present are to be found on or close to the median

line and between the intermediate pore clusters of the segments on which they are present. With proper allowance for variability, these intermediate and median ducts appear to possess definite utility for the differentiation of species.

CICATRICES AND SCLEROTIC AREAS

The first abdominal segment of some, at least, of these species bears a well-defined circular to oval clear area on each side, and this cicatrix may have some taxonomic utility, but the evidence regarding it thus far is too incomplete and too imperfect to permit its full use. It appears satisfactorily only in carefully prepared and stained specimens, and, although it can often be located in others, there is much uncertainty regarding its consistent presence or absence in many of these species. Where there has been any evidence on the point, some statement respecting the presence or absence of this character has been included in the discussion, but such statements should be considered as tentative.

In addition to these cicatrices, certain tiny sclerotic flecks or spots have been noted within the margin of the pygidium of some species. The greatest development observed occurs in *cinerea*, where three flecks appear on each side, the first just anterior to the fourth pygidial lobe and the second and third in corresponding positions on the two abdominal segments preceding this lobe. In two or three other species a single fleck of the same sort has been noted anterior to the fourth pygidial lobe. Although often tiny and difficult to locate, these flecks appear to be relatively constant in their occurrence or absence.

PYGIDIAL LOBES

The lobes of all the species of *Parlatoria* here considered follow a standard pattern as regards the three posterior pairs, although these have more or less definitely specific characteristics, at least with some species. If the studies undertaken in connection with this work have been interpreted correctly, then it is necessary to accept the existence of appreciable variation in the actual and proportional sizes of the lobes making up the three posterior pairs. Although the characteristic average condition of these lobes is usually recognizable for each species, the size variation in some, for example, *pergandii*, is marked. The fourth lobes are present in recognizable form in all these species, but they show extensive variation in shape and sclerotization and appear to possess characteristics of definite taxonomic utility. The fifth lobes likewise are sometimes present in recognizable form. The fourth and fifth lobes, where the latter occur, range in appearance from strongly sclerotized projections on the pygidial margin to delicate, fringed projections closely matching the adjacent plates.

PLATES

The pygidial and abdominal marginal plates occur in a fairly normal pattern throughout these species, but they vary considerably in details of shape, size, and fimbriation. The normal arrangement is two plates between the median lobes, two between the median and second lobes, three between the second and third lobes, and three between the third and fourth lobes, with a more or less continuous

fringe along the remaining abdominal segments. Details of shape and size are given in the discussion of the different species and within limits appear to be useful accessory characters in differentiating the species.

PARAGENITALS

All the species here discussed have clusters of small multilocular disk pores in the usual position on the ventral surface of the pygidium. Most frequently four groups or clusters of these pores are present. Some species normally have five groups; some have four groups, with an occasional specimen showing a fifth, anterior median group; and one species has the two clusters on each side consolidated into an elongated, medially constricted band so that it characteristically has only two groups of paragenitals instead of four. The number of pores in each group and the total number present on a specimen vary materially within a species, but tend to average into a more or less characteristic condition for the species. As examples, *camelliae* may have as few as 19 pores in four groups, while *banksiae* may have as many as 113 in five groups.

OTHER CHARACTERS

Mention should be made here of a structural modification occurring in only one species. *Parlatoria banksiae* appears to lack consistently a marginal macroduct between the median lobes of the pygidium. All the other species discussed have this in normal specimens.

Anatomical characters which have not been given critical consideration in this study, but which might possess elements of taxonomic significance, include the antennae, all ventral ducts and pores except the paragenitals, all setae, sclerotic areas of the pygidium other than the flecks discussed above, and perhaps others.

No study has been made of the second-stage female, the first-stage larva, or any of the male stages of these species, nor has an attempt been made to redescribe the scale coverings, but the normal characteristics of these for each species should be recognizable from the photographic illustrations included in this publication.

DESCRIPTIONS OF SPECIES

PARLATORIA BANKSIAE (Maskell)

(Pl. 1, *A*; pl. 7, *A*; pl. 10, *A*)

This species, originally described in the genus *Mytilaspis* by Maskell (*38, p. 388*),[3] was transferred to *Parlatoria* in 1903 by Leonardi (*33, p. 21*), but the shift apparently was overlooked by Froggatt (*21, p. 606*) in the preparation of his catalog of Australian Coccidae. The species belongs clearly in *Parlatoria* as here accepted.

Adult female.—Eyespot a tiny, irregularly rounded, sclerotized disk, easily overlooked but staining distinctly. Each anterior spiracle accompanied by 3 to 6 disk pores; each posterior spiracle with an inconspicuous dermal pocket, located much nearer to spiracle than to body margin. Duct tubercles of medium size but relatively acutely conical, bases not expanded; numbers in specimens tabulated as follows: Prespiracular 2 to 4, anterior spiracular 6 to 9, intermediate 0 to 1, posterior spiracular 1 to 3, first abdominal 1 to 3. No

[3] Italic numbers in parentheses refer to Literature Cited, p. 31.

marginal macroduct opening between median lobes. Submarginal dorsal tubular ducts rather numerous, extending from apex of pygidium to anterior end of abdomen, size gradually reduced anteriorly, 74 to 84 in number in specimens tabulated. Intermediate dorsal macroducts present and numerous on each side, a cluster of 4 to 5 within the frame of the paragential pore clusters, one of 6 to 7 above the anterior lateral paragenitals, and a cluster on each of the 3 segments anterior to this, the numbers running 9 to 11, 5, 3; in addition with 2 to 4 median clusters of ducts, 2 ducts above the median paragenitals and 1 or 2 on 1 to all of the 3 segments anterior to this; no dorsal microducts noted in association with these. No dorsal abdominal cicatrices located. No dorsal submarginal sclerotized flecks noted on any of the abdominal segments. Three pairs of lobes plainly developed and sclerotized, the first contiguous at bases; the first and second characteristically elongate, strongly protruding, each lobe deeply notched once on outer side, with entire inner margin; third lobes much less prominent, sclerotized portion wider than long, posterior edge diagonal and normally plainly tridentate; fourth lobe suggested by a small, barely protruding, faintly sclerotized, somewhat fringed process on each side of pygidium, so inconspicuous and poorly developed that it hardly deserves to be called a lobe. Plates slender, almost ligulate, continuing along body margin onto anterior abdominal segments; posterior plates fringed apically, anterior plates much suggesting gland spines; normally 4 plates between third and rudimentary fourth lobes, the third of these usually largest of all; plates between median lobes 2, very narrow, and obscure. Paragenitals numerous, in 5 groups; range in numbers in 6 specimens tabulated as follows: Anterior median 6 to 16, anterior laterals 13 to 26, posterior laterals 16 to 28, totals 85 to 113.

Of the forms discussed here, this species perhaps most nearly resembles *Parlatoria cinerea*, but differs from all these in the apparently consistent absence of the median marginal macroduct between the median lobes and in the possession of intermediate dorsal macroducts both within the frame of the paragenitals and anterior to the pygidium proper.

These notes are based on specimens from the Maskell collection (No. 474) and from Victoria, Australia, on *Banksia integrifolia*, collected by C. French and received from E. E. Green in 1916.

PARLATORIA BLANCHARDI (Targioni Tozzetti)

(Pl. 1, *B*; pl. 7, *B*; pl. 10, *B*)

This insect was recently redescribed in careful detail by Stickney (*49*) and is discussed here to record confirmation of previously suggested synonymy and to include it in the key to species and among the illustrations. Any serious student of the genus should consult Stickney's paper on the anatomy of this species.

It has been possible to confirm the synonymy of *Parlatoria proteus* variety *palmae* Maskell (*41*, *p. 229*) with this species through comparison of specimens from the Maskell collection (No. 597) with others from elsewhere in the world. The practical certainty of such synonymy was indicated by Leonardi (*33*, *p. 47*) and by Cockerell (*10*, *p. 186*), but no previous verification of it has been noted in literature. In this connection, no success has been attained in interpreting the remarks by Froggatt (*21*, *p. 602*) respecting the occurrence of *P. proteus* on date palm in Australia. It seems necessary to conclude that Maskell's description of the Australian date palm specimens was overlooked by Froggatt. Incidentally, the Maskell reference cited by Froggatt apparently relates to page 213 of volume 25 of the Transaction of the New Zealand Institute, published in 1893, rather than to page 231 of a volume published in 1887. Buxton

(*4*, *p. 299*) also seems to have overlooked previously suggested synonymy of Maskell's variety with *blanchardi*, since he lists it as valid among the coccids that have been reported from the date palm.

Adult female.—Eyespot present, a prominent, well-sclerotized, rounded disk. Anterior spiracle with pores adjacent, the number ranging from 1 to 8, usually 2 or 3; posterior spiracles without derm pocket adjacent, between spiracle and body margin. Duct tubercles wholly lacking. Submarginal dorsal macroducts comparatively few in number, relatively inconspicuous, 7 to 9 noted in specimens examined. Intermediate dorsal macroducts wholly lacking, but with a few widely scattered microducts in this area, extending anteriorly from 1 or 2 above each anterior lateral paragenital cluster. No cicatrices observed on dorsum of abdomen. A single sclerotized oval fleck dorsally anterior to each fourth lobe; no others observed. Three pairs of lobes plainly developed, characteristically entire, or at most slightly notched or serrate, spatulate, usually with internal extension, appearing plainly longer than wide; location of fourth lobes marked by a slight, apically roughened, not or very slightly sclerotized protrusion of the margin. Plates short and stubby; anterior plates suggesting gland spines, those posterior to fourth lobes plainly though not conspicuously dentate, those between the third and fourth lobes the broadest, none very wide as in some other species. Paragenitals in 4 groups, no median anterior present; range in number of anterior laterals in specimens tabulated 1 to 14, average 8; range of posterior laterals 0 to 10, average 6.

The combination of characters that appears to distinguish this species includes complete absence of prosomal or other duct tubercles, relatively very large eyespot, characteristically entire, short spatulate first to third lobes, and small number of submarginal dorsal ducts.

Specimens of this insect on date palm (Palmae) have been examined from the following localities: Algeria, Arabia, Arizona, Australia, California, Egypt, India, Iraq, Palestine, Sudan, Tripoli, Tunis, and Turkey.

PARLATORIA CAMELLIAE Comstock

(Pl. 2, *A*; pl. 7, *C*; pl. 10, *C*)

Comstock in 1883 (*13*, *p. 114*) first differentiated this insect from the other species of *Parlatoria* then known, but considered that it should stand only as a variety of *pergandii*. For many years thereafter no new records for the occurrence of this insect appeared in the literature, the second such report apparently being that made by King (*29*, *p. 62*) in 1902, when he announced the discovery of the species in the Harvard Botanical Garden. In 1912 (*55*, *p. 739*) for the first time the insect was reported from Japan at quarantine on *Camellia* and *Acer*.

Adult female.—Eyespot plainly present but not conspicuous, irregularly circular to oval, more or less protruding to hemispherical or even more elongate, but never approximating the shape of a short, stout spine or spur. Anterior spiracles with 2 to 4 pores adjacent; posterior spiracles with a relatively distinct, although not large or conspicuous, derm pocket about one-third of distance between spiracle and margin. Duct tubercles fairly numerous and rather strongly conical but with apex rounded, with more or less spreading of the sclerotic area around the base of each; numbers on each side as follows: Prespiracular 2 to 4, anterior spiracular 2 to 5, intermediate 4 to 6, posterior spiracular 4 to 6, first abdominal 3 to 7, totals 15 to 28. Submarginal dorsal ducts few, 20 to 28 on each side of body, extending onto second abdominal segment. No dorsal intermediate macroducts near middle of body; instead on each side with 2 to 4 intermediate microducts above the anterior lateral paragenitals and 5 to 12 microducts on preceding segment, at edge of sclerotized dorsal area of pygidium; rarely with a submedian microduct in line with the intrapygidial row, 1 or 2 opposite prepygidial row and with from 1 to 4 intermediate micro-

ducts on segment anterior to the prepygidial row. No other dorsal ducts noted in this area. An approximately circular dorsal cicatrix well in from margin on each side of first abdominal segment. A sclerotic fleck, much smaller than cicatrix and oval, anterior to each fourth lobe; no others noted. Lobes comparatively small, approximately equal in size; inner pair distinctly notched once on each side; second pair distinctly notched on outer margin, slightly notched or more frequently sinuate on inner margin; third lobes as with second, very faintly notched if at all, inner margin sometimes appearing entire, not even sinuate; each fourth lobe normally represented by an angular protrusion, somewhat sclerotized and usually appearing definitely broader than in *crotonis*, with a more strongly protruding apical tooth and characteristically a single small denticle on inner edge and 4 or 5 on sloping outer edge, but varying greatly in details of shape and structure, even, although rarely, resembling the third lobe in these respects; fifth lobes each represented by a marginal projection, this very strongly suggestive of the adjacent plates, differing chiefly in that it is about half the length of a plate. Plates practically as in *crotonis* and related species. Paragenitals few in number, in 4 groups; anterior laterals in specimens tabulated, range 4 to 11, average 7; posterior laterals, range 4 to 9, average 6; totals, range 19 to 33, average 25.8.

In all the structural characters examined this insect is extraordinarily close to *P. crotonis*. There are habitus differences, difficult to put in a description, but with the normal variation in structure the presence or absence of a strong prosomal spur is apparently the only constant and easily distinguishable characteristic for separating the two forms. Beyond this there are various collections, some previously placed as *camelliae*, from tropical Asia on several hosts that are left in an uncertain status by this study. Morphologically they are extremely close to this form, but exhibit certain minute differences in structure which with more detailed study of ample material may be shown to be of taxonomic significance.

Published records have accumulated rapidly since 1912 and include records on *Acer* (Aceraceae) from Japan; on *Aegle* (Rutaceae) from India; on *Azadarachta* (Meliaceae) from India; on *Camellia* (Theaceae) from Argentina, California, China, Italy, Japan, Malta, and Sicily; on *Citrus* (Rutaceae) from China, French Guinea, Malta, Mississippi, and Spain; on Cape-jasmine (Rubiaceae) from Kansas (plants introduced from Louisiana); on *Cinnamomum* (Lauraceae) from China; on croton (Euphorbiaceae) from Italy; on *Euonymus* (Celastraceae) from Mississippi; on *Jasminum* (Oleaceae) from China; on *Melia* (Meliaceae) from India; and on *Vitis* (Vitaceae) from India. Surely some of these records are confused (for example, that on croton from Italy), but it may prove impossible to check the accuracy of many of them.

A considerable number of specimens from the collections have been placed as this species, including some on *Camellia* (Theaceae) from California, Georgia, Louisiana, Mississippi, Oregon, and South Carolina in the United States; from France, Italy, and Switzerland, mostly at quarantine; and from Japan and Chosen; on camphor (Lauraceae) from Georgia and Louisiana; on sweet olive (Oleaceae) from Louisiana, Mississippi, South Carolina, and Texas; on "laurel" from Louisiana; on myrtle (Myrtaceae) from Mississippi; and on *Osmanthus* (Oleaceae) from Louisiana in the United States; on *Citrus* (Rutaceae) from Italy; on *Azalea* (Ericaceae) and *Euonymus* (Celastraceae) from Japan, on *Osmanthus* and *Poncirus* (Rutaceae) from Chosen; and on mango (Anacardiaceae) from Java.

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PARLATORIA CINEREA Hadden

(Pl. 2, *B*; pl. 7, *D*; pl. 10, *D*)

Originally described in a paper by Deane and Hadden (*16, p. 299*), in subsequent literature this insect was credited to these two authors until Lindinger (*35, p. 151*) stated that the species properly should be credited to Cockerell and Hadden. An examination of the original paper shows, however, that the species must be credited to Miss Hadden alone, since the introduction (*16, p. 296*) states that "Miss Hadden * * * should be credited with the new species of *Parlatoria*."

Although it has been mentioned in literature under this name only a few times, the species is already much involved in synonymy, and present evidence indicates that it is not only very widely distributed but is of definite actual or potential economic importance.

Since 1899 specimens of this insect have stood in the national collection of Coccidae under the manuscript name *braziliensis*, the first specimens having come from material from Brazil intercepted at the port of Hamburg, Germany. Subsequently the species has been encountered many times from Brazil on citrus fruits reaching ports in the United States, and it was finally, in 1934, described from *Citrus* from that country by Costa Lima (*14, p. 134*) as *Parlatoria fluggeae* variety *brasiliensis*. His description and accompanying illustration are so good as to leave no doubt regarding the identity of the species.

For many years the Bureau of Entomology when identifying this species used the name *Parlatoria braziliensis* ms. or *brasiliensis* ms., and this designation appeared at least twice in literature, Reinking and Groff (*47, p. 426*) reporting the insect as abundant on pomelo in Siam in 1921 and Woodworth (*56, p. 52*) listing it in 1922 from the Philippine Islands on *Citrus*, in neither case with sufficient descriptive information to fix the name.

Another name for this insect was proposed in 1932 when Kuwana (*32, p. 15*) described, in Japanese, the species *pseudopyri* on *Jasminum* from China. Here again the information supplied is sufficient to permit definite placing of this name as a synonym of *cinerea*.

In 1936 Lindinger (*35, p. 151*) placed *cinerea* as a synonym of *Parlatoria oleae* Colvée, an unfortunate action in view of the economic importance of both insects, normal specimens of which can be differentiated readily.

Adult female.—Eyespot normally present, but very obscure and easily overlooked, only slightly differentiated from adjacent derm. Not located on every specimen examined, and perhaps actually wanting on some. Each anterior spiracle with a number of disk pores adjacent, range from 5 to 11 in material examined; no dermal pocket observed between posterior spiracle and margin, but a straggling row of small tubular ducts in this area. Duct tubercles varying considerably in shape and size, from relatively short, broad, rounded conical to high, narrow, rounded conical, the short form most frequent; not numerous, prespiracular 1 to 4, anterior spiracular 3 to 4, intermediate 2 to 4, posterior spiracular 1 to 4, first abdominal 1. Submarginal dorsal tubular macroducts intermediate in number, extending from apex of pygidium onto second abdominal segment; numbers for each side of body ranging from 37 to 50. Intermediate tubular macroducts present, characteristically, on each half of body, with a row of 3 or 4 inside paragenitals close to anal opening, and an elongate cluster of 3 to 9 above or just outside paragenitals and still within

sclerotized area of dorsal surface of pygidium, the posterior end of this cluster often joining the adjacent submarginal ducts; no additional intermediate or median dorsal ducts, either macro or micro, observed anterior to pygidium. A circular to oval cicatrix near body margin dorsally on first abdominal segment, this sometimes obscure. Characteristically with 3 small, oval, dorsal, submarginal, sclerotized flecks independent of other pygidial sclerotization on each side, the last located just anterior to the fourth lobe, the other 2 on 2 segments preceding that bearing this lobe. Lobes strongly protruding, median largest, notched once internally and usually twice externally, second and third proportionately reduced, entire along inner margin, usually twice notched along outer margin, notches in all lobes sometimes reduced or increased in number; fourth lobes represented by a broad, slight protrusion, not or slightly sclerotized, outer margin paralleling line of pygidial margin, and with or without a few minute teeth. Plates elongate, each narrowing to end in a conspicuous linear elongation, margins toward the apex more or less fimbriate, protrusions short; those plates between the lobes slender, ligulate, those outside the fourth lobes much broader at base and tapering strongly to the slender apex; 3 plates between third and fourth lobes intermediate, broader than those inside third lobes, but elongate and tapering gradually. Paragenitals intermediate in number, characteristically in 4 groups, but sometimes with a single pore representing a median cluster; numbers in specimens tabulated as follows: Anterior median 0 to 1; anterior laterals, range 7 to 16, average 10.66; posterior laterals, range 8 to 14, average 11.85; totals, range 33 to 57, average 46.1.

This species has a number of characters that are sufficiently distinctive and persistent to permit its ready recognition. The presence of dorsal intermediate macroducts close to the anal opening and on the immediately preceding segment but not beyond this, the presence on each side of the pygidium of three small oval sclerotized flecks, one near the margin anterior to the fourth lobe and one in corresponding position on the two segments preceding this, the strongly protruding, externally twice-notched lobes, and the slender to strongly tapering plates, with prominent linear apical extension, in combination present a distinctive specific picture.

Described (*16, p. 299*) from orange and an undetermined vine from the Society Islands; in addition to the records previously mentioned, *cinerea* has been reported in literature from Samoa on orange (*15, p. 402*), on the same host from Mexico at quarantine in California as early as 1921 (*54, p. 29*), from Indo-China on *Citrus* (Rutaceae) by Bellio (*1, p. 227*), from Taiwan (Formosa) on *Citrus* by Takahashi (*51, p. 38*), and from Mexico on *Jasminum* (Oleaceae) by Ferris (*20, p. 81–86*).

The unpublished records of collections, especially those of plant-quarantine interceptions,[4] are a real source of knowledge of the distribution of this insect. Specimens have been examined that were reported as collected on various species and varieties of *Citrus* from Mexico, the District of Columbia, and Maryland (greenhouse) in North America; from Cuba, Dominica, Grenada, Haiti, Jamaica, Montserrat, St. Lucia, and Trinidad in the Caribbean area; from Argentina, Brazil, and Dutch Guiana in South America; from Italy, Spain, and Palestine in the Mediterranean area; from South Africa;

[4] It is necessary that caution be exercised in accepting as completely accurate the records coming from some types of plant-quarantine interceptions. Often these specimens are from fruits carried for consumption in ships' stores, and the practical difficulties in tracing the original source of individual fruits, especially of fruits so universally handled commercially as are the citrus fruits, are obvious. Thus, with only single records from Italy, Spain, and South Africa, the certainty of the establishment of the species in these countries might well be questioned. In contrast, with five records over a period of years, one from a mail shipment, it seems safe to conclude that *cinerea* actually is established in Palestine.

from China, Java, Philippine Islands, Siam, and Straits Settlements in the southeastern Asiatic area; and from Samoa and Tahiti among the Pacific Islands. Specimens examined from other hosts and localities include examples on jasmine and an undetermined host from the District of Columbia (greenhouse), on *Viburnum* (Caprifoliaceae) from Maryland (greenhouse), on *Mangifera* (Anacardiaceae) from Jamaica, on *Bougainvillea* (Nyctaginaceae) from Central America, on rose (Rosaceae) from Mexico, on gardenia (Rubiaceae) from Brazil, and on undetermined hosts from India, New Caledonia, and the Marquesas Islands.

PARLATORIA CROTONIS Douglas

(Pl. 3, *A*; pl. 8, *A*; pl. 10, *E*)

First established by Douglas (*17*, *p. 242*) as a variety of *Parlatoria proteus*, this insect has been variously considered as a variety or even a synonym of *proteus* or of *P. pergandii* as recently as 1935, although Cockerell (*9*, *p. 59*) expressed the opinion in 1902 that it is a definitely recognizable species. Although no specimens from those on which Douglas actually based his name have been available for examination, there seems to be no question of the identity of his specimens with those collected subsequently on croton from many sources.

The form appears to be recognizable whenever it is encountered, and its acceptance as a distinct species seems much to be preferred to a varietal association that has no biological or genetic background to support its validity.

Adult female.—Eyespot consistently developed, in all specimens in which the condition can be satisfactorily observed, into a stout spur, usually conspicuous owing to protrusion from the body margin.[5] Anterior spiracles with 2 or 3 pores adjacent; posterior spiracles with a small dermal pocket about one-third the distance from spiracle to margin and clearly visible in carefully stained specimens. Duct tubercles low conical but with a roughly circular area of varying extent and intensity of sclerotization around the base of each, few in number, prespiracular 1 or 2, anterior spiracular usually 2, intermediate 2 to 4, posterior spiracular 3 to 5, first abdominal 1 to 3. Submarginal dorsal tubular ducts moderate in number, extending from apex of pygidium onto second abdominal segment, 28 or 29 present; intermediate and median dorsal macroducts lacking, but with intermediate microducts, usually 1 or 2 above the anterior lateral paragenitals, on each side, within the dorsal sclerotized area, but these often wanting, and on each side 3 or 4 on the preceding segment just at the anterior edge of the sclerotized area. No dorsal cicatrix noted on abdominal segments. No independent dorsal sclerotic flecks noted near margin on pygidial segments. Three pairs of normally developed lobes almost equal in size, the second and third slightly smaller, sometimes with median lobes plainly broadest and the other 2 graduated in size, all relatively slender, first and second conspicuously notched on both inner and outer margins, third lobe usually only on outer margin but with inner margin somewhat sinuate; fourth lobe represented by a small but definitely sclerotized, angular protrusion of the body wall having characteristically 1 long and 2 or 3 minute projecting teeth; fifth lobes represented by a very similar projection. Plates between posterior 3 pairs of lobes narrow, but narrowly spatulate rather than ligulate; remainder all broad to very broad, continuing onto posterior angle of first abdominal segment; those on first 3 abdominal segments tending to a rounded or somewhat pointed tip,

[5] At a point dorsally approximating that at which the eyespot might occur a cicatrix is visible that is somewhat suggestive of the structure called the eyespot in some other species, making it possible that this spur has been misinterpreted and that it should be considered a distinct structure.

remainder strongly fimbriate with numerous slender projections, 1 or 2 to each plate usually slightly stouter and somewhat more conspicuous; 3 wide plates between third and fourth lobes; 4 wide plates between fourth and fifth lobes. Paragenitals few in number, in 4 groups; anterior laterals 6, posterior laterals 5 to 7 in specimens tabulated; totals, range 22 to 24, average 23.

The strong prosomal marginal spur, usually plainly evident, together with the triangular sclerotized fourth lobe of the pygidium, gives a positive basis for the differentiation of this form from the others here considered. Although not distinctive, other characters that should be considered in conjunction are the small number of duct tubercles, the total per side for all segments ranging from 7 to 12, the apparent lack of cicatrices and sclerotic flecks, and the small number of paragenitals.

In the literature, so far as this has been examined, this insect has been reported on croton (*Codiaeum*, Euphorbiaceae) from Massachusetts and Ohio (in greenhouses); from Central America and Panama; from British Guiana; from Antigua, Cuba, Haiti, and Jamaica in the West Indies; from England (in greenhouses); from Italy; from Egypt; from India; and from the Hawaiian Islands. From the island of Formosa (Taiwan) Takahashi (*50, p. 78; 52, p. 103; 53, p. 4*) has reported this species from *Acer* (Aceraceae), *Dendrobium* (Orchidaceae), *Ficus* (Moraceae), and *Illicium* (Magnoliaceae). From an examination of specimens involved in the record, Brain's report (*3, p. 212*) of the presence of *Parlatoria pergandii* on croton in South Africa proves to relate to *crotonis* rather than *pergandii*.

Specimens in the collection that have been examined were taken on croton from California, the District of Columbia, Illinois, Louisiana, Massachusetts, New York, Ohio, all but those from Louisiana presumably under glass; from Mexico, Nicaragua, Costa Rica, Panama, Canal Zone, and British Guiana in continental North America south of the United States; from Cuba, Haiti, Jamaica, Puerto Rico, St. Lucia, and Trinidad in the West Indies; from England; and from the Hawaiian Islands. There are a few collections reported as from other hosts, but they represent no localities additional to those already listed, and a possibility exists that error may have crept into the records with at least some of these collections, on which account they are not discussed here.

PARLATORIA FULLERI, new name

(Pl. 3, *B*; pl. 8, *B*; pl. 10, *F*)

In August 1897 Fuller (*22, p. 1344*), in a paper entitled "Some Coccidae of Western Australia," mentioned a "*P. viridus* n. sp. on *Pittosporum*, Perth," but without description other than an indication that it was near *pittospori* Maskell. Two years later (*23, p. 467*) he gave the species validity through the publication of a fairly extended description in a more detailed paper on Western Australian Coccidae. The insect is listed as valid under this name in various catalogs, including those of Fernald (*19, p. 322*) and Froggatt (*21, p. 603*), and by some obscure twist is held by Palmer (*46, p. 142*) to take precedence over *viridis* Cockerell (*6, p. 21*), 1896, but to be a synonym of *proteus* Curtis. In the face of Cockerell's belief

that his variety *viridis* might actually be a new species, "v. nov. vel n. sp.," it seems necessary to give his name full nomenclatorial standing and to replace the name *viridis* of Fuller, since Fuller's name was first published more than a year after *viridis* was used in *Parlatoria* by Cockerell, and since it actually stands for an apparently distinct Australian species. No indication has been found in literature that this situation has been recognized previously, and indeed there is no evidence that the species has been known to present-day coccid workers. The conclusions here reached and the descriptive information presented have been based on a study of specimens from Fuller's type material and from other sources as indicated.

Adult female.—Eyespot a small, irregularly oval, sclerotized spot, often difficult to locate and possibly lacking at times on one or both sides of the body. Anterior spiracles with 2 or 3 disk pores adjacent, more often with 2; posterior spiracles with a relatively conspicuous invaginated pocket about midway between spiracles and margin. Duct tubercles stout conical, apices slightly rounded, bases more or less widened; numbers for one side of body as follows: Prespiracular, range 1 to 3, average 1.56; anterior spiracular, range 1 to 6, average 3; interspiracular, range 2 to 5, average 3.25; posterior spiracular, range 2 to 5, average 3.65; first abdominal, range 2 to 4, average 3; totals, range 9 to 19, average 14.33. Submarginal dorsal tubular ducts moderate in number in the specimens tabulated, ranging from 17 to 47 on each side, with an average of 27. No intermediate dorsal tubular macroducts, but with microducts on dorsum of anterior abdominal segments, the number and arrangement varying considerably and difficult to ascertain accurately in imperfect specimens; without microducts within frame of paragenitals, very rarely with a single duct on each side above paragenitals, but with one to several such ducts on each side and often also on or near the midline on remaining anterior segments, the numbers noted in the specimens tabulated, listing the segments from the pygidium anteriorly, as follows: First, range 1 to 5, average 2.24, sometimes with 1 median duct; second, range 2 to 8, average 4, sometimes with 1 or 2 median ducts; third, range 2 to 6, average 3.4, usually with a median duct; fourth, range 1 to 6, average 2.9, normally with 1 or 2 median ducts; fifth, range 1 to 5, average 2.6, often with 1 or 2 median ducts. A small, approximately circular cicatrix usually present dorsally on each side of abdomen, apparently on the anterior margin of the second abdominal segment. No special sclerotic flecks observed. Three pairs of normally developed lobes, rather slender, nearly uniform in size, strongly notched on both inner and outer margins; fourth and fifth lobes represented by oval, strongly fimbriate structures practically identical in appearance with adjacent plates. Plates not peculiar, those between normal lobes not unusually slender, those beyond third lobes mostly oval in shape, with constricted base; outer margins of all but those on anterior abdominal segments strongly fimbriate. Paragenitals characteristically in 2 elongate groups, 1 on each side of genital opening, each group more or less constricted near middle, indicating a probable relationship to or derivation from those species having 4 separated clusters of paragenitals; the total number of paragenital pores ranging from 37 to 63, with an average of 51, and the range in 1 compound cluster from 18 to 32.

The previously published discussion of this insect appears to have been based entirely on Fuller's original collection. In this study specimens from several sources have been examined, including part of Fuller's type material, in the national collection of Coccidae; on *Pittosporum* (Pittosporaceae) from Perth, Western Australia, on *Pittosporum* from Melbourne (No. 338) and Brisbane (No. 1099), on *Acacia* (Leguminosae) from Lismore, New South Wales, on palm (Palmae) from Sydney (No. 20263), and on "various plants" from Sydney (No. 634), all collected by George Compere. In addition the insect was collected at quarantine at Philadelphia on palm from

Australia by A. B. Wells in 1933 (Phila. No. 17911), and on palm from France by A. G. Harley in 1928 (Phila. No. 9191).

The combination of platelike fourth and fifth lobes, paragenitals combined into two clusters, and relatively numerous dorsal intermediate microducts on the anterior abdominal segments seems to provide an adequate basis for the recognition of this species.

PARLATORIA OLEAE (Colvée)

(Pl. 4, *A*; pl. 8, *C*; pl. 11, *A*)

Owing chiefly to Lindinger's work (*34, p. 111*) the so-called olive parlatoria, the species described as *Parlatoria affinis* Newst. and *calianthina* Berl. and Leon., has come to have the name *P. oleae* (Colvée) generally accepted for technical reference use. It has been assumed here that Lindinger's study of Colvée's very extended discussion of his species (*11*) has fully substantiated his conclusion as to its zoological identity, although, as will be noted, some of the synonomy of other species with this that has been published by Lindinger has proved definitely unacceptable.

In 1936 Lindinger (*35, p. 150*), in a miscellaneous discussion on scale insects, listed a number of species and varietal names as synonyms of *Parlatoria oleae* (Colvée). There are no type or other authentic representatives of a part of these at hand for study, and to avoid further confusion no mention is made here of names unrepresented by study material, although with some the synonomy listed by Lindinger has been confirmed by other workers on the basis of actual examination of authentic specimens belonging with the name.

Among the names included in Lindinger's list are *Parlatoria affinis* Newst. (*44, p. 97*) and *P. calianthina* Berl. and Leon. (*2, p. 346*), long accepted as synonyms of *oleae*. Examination of cotype specimens of the first and presumably authentic Italian specimens of the second confirms this synonomy. Among others listed are *P. theae* Ckll., *viridis* Ckll. (described as *theae viridis*), *theae euonymi* Ckll., *sinensis* Maskell, and *cinerea* "Cockerell and Hadden." The last, *cinerea*, has been discussed earlier in this publication, and there will be fuller treatment of the others later under the names *theae* and *pergandii*. At this point it is sufficient to state that on the basis of a study of type specimens of each it is erroneous to place any of them as a synonym of *oleae*.[6]

Adult female.—Eyespot located near body margin, of medium size, irregularly oval, very lightly sclerotized, and often not recognizable owing to condition of specimen. Each anterior spiracle accompanied by 3 to 10 disk pores; posterior spiracles without an invaginated dermal pocket between each and body margin. Duct tubercles short conical, larger posteriorly, only slightly expanded, relatively numerous on prosoma; numbers for each side of body as follows: Prespiracular, range 0 to 5, average 2; anterior spiracular, range 4 to 12, average 7; intermediate, range 1 to 10, average 3.75; posterior spiracular, range 0 to 7, average 2.2; first abdominal, range 0 to 3, average 1.1; total number per side, range 9 to 34, average 16. Submarginal dorsal tubular ducts usually numerous, 50 or more on each side of body, observed range 29 to 100 to a side, average 69;

[6] Through the consideration of its describer, the writer recently has been able to examine specimens representing part of the type material of *Parlatoria fluggeae* Hall (Bull. Ent. Research 20: 359–360. 1929), another one of the species placed by Lindinger as a synonym of *oleae*. Hall's species is plainly not identical with *oleae*. Instead, it very closely resembles *cinerea* Hadden but appears, from the material examined, to be wholly without the large dorsal macroducts within the frame of the paragenital pores which are so conspicuous a feature of *cinerea*.

liable to confusion anteriorly with similar but smaller ventral submarginal ducts. Intermediate dorsal tubular macroducts present, 1 to 5 above each anterior lateral paragenital cluster, 1 to 7 before these on anterior edge of dorsal general sclerotized area of pygidium, and 0 to 6 on preceding segment; occasionally (e. g., in some North African specimens) 2 or 3 such ducts above posterior lateral paragenital cluster somewhat suggesting the normal condition in *cinerea*. No cicatrices on dorsum of first abdominal segment or elsewhere, and no small isolated sclerotized flecks observed on dorsum of pygidium. Apical 3 pairs of lobes similar, broad and stout, deeply notched once on exterior margin; median largest, third smallest; median perhaps normally notched distinctly but not deeply on inner margin, second notched faintly on inner margin, third with inner margin slightly sinuate, but all traces of internal notching or sinuation often completely wanting; fourth and sometimes fifth and sixth lobes represented by slight but definitely sclerotized projections of the pygidial margin, each having its margin drawn out into a broad spur, approximately centrally located rather than near the inner edge as in some other species, this margin, in addition, more or less distinctly serrated; the anterior or sixth pair of lobes often membranous projections only. Plates between posterior three pairs of lobes elongate, roughly parallel-sided, slender, but with apices hardly exceeding notch in lobe bounding inner side of any group of plates; plate apices unequally fimbriate or toothed, but without a single conspicuously longer projection; the usual number, 2 between median and between first lateral and median lobes, 3 between second and third lobes, and apparently with 4 plates between third and fourth lobes; but this appearance, so far as can be determined, due to the development in the intermediate plate of a deep median cleft or split extending to or almost to the body margin,[7] with 5 or 6 plates between fourth and fifth lobes and between fifth and sixth when this last is developed; plates continuing onto first abdominal segment, this usually with one at its posterior corner; all these plates broader than those first described, obscurely dentate or fimbriate apically and varying basally from somewhat constricted to somewhat widened. Paragenitals usually in 5 well-developed groups, the anterior median sometimes much reduced or wanting; tabulated ranges as follows: Anterior median 0 to 7, average 3; anterior lateral, range 10 to 29, average 19.5; posterior laterals, range 10 to 21, average 15; totals, range 45 to 100, average 72.

The combination of heavy pygidial lobes, deeply notched once externally, numerous dorsal submarginal ducts and paragenitals, the latter usually in five groups, dorsal intermediate tubular macroducts, and, above all, the cleft intermediate plate between the third and fourth lobes adequately separates this species from all the others here considered.

This species, under its accepted name or its authenticated synonyms, has been reported in literature from many hosts and localities, these published reports indicating a wide distribution throughout the countries bordering the Mediterranean and through Asia Minor into India. There are isolated reports of unchecked validity from Argentina, Brazil, China, and New South Wales, and the species has been positively reported in the United States from Maryland, Arizona, and California. The list of hosts is large and growing, with economic species and varieties of Rosaceae the most strongly represented of any plant groups. Extensive host lists are included in the papers by Nichol and Wehrle (*45, pp. 225–227*) and Koronéos (*30, pp. 31–32*). Host-plant genera that have been noted in literature include, in Anacardaceae, *Mangifera*, *Pistacia*, *Rhus*, *Schinus;* in Anonaceae, *Saccopetalum;* in Apocynaceae, *Carissa*, *Nerium*, *Vinca;* in Aquifoliaceae, *Ilex;* in Araliaceae, *Hedera;* in Berberidaceae, *Berberis;* in Bignoniaceae, *Bignonia*, *Camosis*, *Kigelia;* in Cactaceae, *Cactus;* in Caprifoliaceae, *Viburnum;* in Caryophyllaceae, *Dianthus;* in Elaeagnaceae,

[7] Among the several hundred specimens of this species that have been examined, this plate was found in the uncleft condition characteristic of other species only once, and then on only one side of the specimen.

Elaeagnus; in Euphorbiaceae, *Aleurites;* in Juglandaceae, *Juglans;* in Labiatae, *Rosmarinus*, *Salvia;* in Lauraceae, *Laurus;* in Leguminosae, *Acacia*, *Gleditsia*, *Gymnocladus*, *Robinia;* in Liliaceae, *Asparagus*, *Convallaria*, *Ruscus;* in Magnoliaceae, *Michelia;* in Moraceae, *Ficus*, *Maclurea*, *Morus;* in Myrtaceae, *Myrtus;* in Oleaceae, *Fraxinus*, *Jasminum*, *Ligustrum*, *Olea*, *Syringa;* in Orchidaceae, *Orchis;* in Palmae, *Phoenix*, *Trachycarpus;* in Punicaceae, *Punica;* in Ranunculaceae, *Clematis:* in Rhamnaceae, *Rhamnus;* in Rosaceae, *Cotoneaster*, *Crataegus*, *Eriobotrya*, *Mespilus*, *Photinia*, *Prunus* (including *Amygdalus*), *Pyracantha*, *Pyrus*, *Rosa;* in Rutaceae, *Citrus;* in Salicaceae, *Populus*, *Salix;* in Umbelliferae, *Foeniculum;* in Vitaceae, *Parthenocissus*, *Vitis*.

This coccid has been received frequently for identification, especially from plant-quarantine inspection sources, and in consequence several hundred specimens have been examined in the course of this study. Material has been studied from every political unit bordering the Mediterranean except Albania and Turkey, from Portugal in Europe; from Russian Caucasus, Russian and Chinese Turkestan, Persia (Iran), Kashmir and elsewhere in India in Asia; from Argentina in South America; and from Arizona, California, and Maryland in the United States. From the fact that some of these specimens are from noncultivated species of *Pyrus* and *Ligustrum* growing in wild and mountainous areas in Turkestan and Caucasus, it may be legitimate to assume that this area represents the original home of this insect, and that it has spread gradually through the remainder of its present known area of distribution as a result of dissemination of infested plant material. The frequency with which the species has been found at quarantine on various commercially produced rosaceous fruits, together with the experience already reported for Arizona (*45*) and Maryland (*42*), indicates that in this insect there has been definitely established in the United States another potential fruit pest.

The summarized record of data associated with specimens examined follows. In the Rosaceae, on *Crataegus oxyacantha* from Italy; on *Eriobotrya japonica* from India and Italy; on *Mespilus germanica* from Italy, Russian Caucasus, and Sicily; on *Prunus armeniacum* (apricot) from Italy, Palestine, Sicily, Spain, Syria, and Tunis; on *P. communis* (almond) from Arizona, Italy, Sicily, Spain, and Syria; on *P. domestica* and *Prunus* sp. (plums) from Algeria, Argentina, California, France, India, Italy, and Tunis; on *P. domestica insititia* (damson) from Arizona; on *P. mume* from Algeria; on *P.* (*Amygdalus*) *persica* (peach) from India, Italy, Spain, and Tunis; on *P.* (*Amygdalus*) *persica nucipersica* (nectarine) from Italy and Morocco; on *Prunus* (*Cerasus* and *Padus*) (cherries) from Italy; on *Prunus* sp. from Italy, Morocco, and Russian Caucasus; on *Pyrus* (*Malus*) *malus* (apple) from Arizona, Chinese Turkestan, Egypt, Greece, India, Italy, Libya, Morocco, and Spain; on *P.* (*Malus*) *malus fornorina* from Morocco; on *P.* (*Pyrophorum*) *communis* (pear) from Algeria, Arizona, Greece, India, Italy, Portugal, Russian Caucasus, and Spain; on *P.* (*Pyrophorum*) *amygdaliformis* from Yugoslavia; on *Pyrus* (*Pyrophorum*) *salicifolia* from Russian Caucasus; on *P.* (*Sorbus*) *domestica pyriformis* from Italy; on *P. gharbiana* from France; on *Pyrus* spp. from

Algeria, Italy, and Tunis; on *Rosa* sp. (rose) from Arizona, Greece, Italy, Spain, and Syria; in the Oleaceae, on *Jasminum humile* from Arizona and Italy; on *Ligustrum ovalifolium* (privet) from Arizona and California; on *L. vulgare* from Maryland and Russian Turkestan; on *Olea europaea* (olive) from Arizona, France, Greece, Italy, Yugoslavia, Morocco, Spain, and Syria; in the Anacardiaceae, on *Pistacia lentiscus* (pistache) from Persia (Iran) and Yugoslavia; in the Apocynaceae, on *Nerium oleander* (oleander) from Arizona; in the Betulaceae, on *Corylus avellana* (filbert) from Italy; in the Ebenaceae, on *Diospyros* (persimmon) from Greece and Italy; in the Lauraceae, on *Laurus* (laurel) from Italy; in the Rhamnaceae, on *Rhamnus pallassii* and *Rhamnus* sp. from Russian Caucasus; in the Rutaceae, on *Citrus grandis* (grapefruit) from Spain; in the Vitaceae, on *Vitis* sp. (grape) from Greece; and on unknown or unstated hosts from Argentina and Italy.

PARLATORIA PERGANDII Comstock

(Pl. 4, *B;* pl. 8, *D;* pl. 11, *B*)

First described from Florida in 1881 by Comstock (*12, p. 327*), this insect has been reported in subsequent years from many parts of the world, mostly from citrus hosts, although a number of other host plants have been recorded for the species. There appears to have been some confusion in literature respecting the identity of *pergandii*, but only one definitely recognized synonym can be recorded, namely, *sinensis* Maskell (*40, p. 241; 41, p. 228*). Specimens from Maskell's type material, although not wholly satisfactory for study, and not representing an average picture of the species *pergandii*, on examination disclose no sound morphological basis for segregation. Despite the lack of established synonyms there has been a decided difference of opinion in published work over the status and relationship of this species, it having been variously placed as a synonym or as a variety of *proteus*, and the forms *crotonis*, *camelliae*, *pittospori*, and *theae*, here considered as distinct, having been placed as varieties or in some instances as synonyms under it.

Many of the records in literature under the name *pergandii* almost certainly relate to forms here placed as distinct species, but the exact status of every published record may never be completely clarified.

Adult female.—Eyespot a small, roughly rounded to oval, inconspicuous fleck, often difficult to observe. Anterior spiracles with 3 to 5 disk pores adjacent; posterior spiracles without any traces of an adjacent dermal pocket but with 2 to several small tubular ducts scattered between opening and body margin. Duct tubercles anteriorly short, flat conical, with bases expanded, somewhat smaller and more elongate conical posteriorly, and varying considerably in size; range in numbers on each half of body, prespiracular 1 to 5, average 2.7; anterior spiracular 3 to 10, average 5.6; intermediate 2 to 7, average 3.6; posterior spiracular 1 to 6, average 3.3; first abdominal 1 to 4, average 1.9; totals 10 to 29, average around 18. Dorsal submarginal tubular macroducts usually rather numerous, but varying considerably; tabulated range, each half of body, 29 to 70; average number around 50. No intermediate or median macroducts and characteristically without but sometimes with a single microduct above anterior lateral paragenitals, well within dorsal sclerotized area of pygidium, and characteristically with 2 to 5 such microducts on preceding segment, along anterior edge of this sclerotization; no dorsal microducts observed anterior to these. A faint, irregularly rounded to oval cicatrix dorsally, well in from margin, on first abdominal segment, this showing in some well-prepared specimens but not certainly visible in many preparations examined and constancy

not established. The 3 pairs of normally developed lobes not conspicuously large as in *cinerea*, or small as in *camelliae*, all similar in shape, but plainly graduated in size from median to outer, the actual size of the lobes and the degree of gradation varying considerably in the material studied, with a corresponding influence on the general appearance of the apex of the pygidium; fourth lobe represented by a definitely sclerotized asymmetrical short conical projection of body margin having usually 1 or 2 minute teeth on inner margin and 2 or 3 on outer; can be described also as a sclerotized projection of body margin having 1 relatively very large and conspicuous projecting tooth just inside its midline and some minute teeth on each side of this; fifth lobe usually present and similar in appearance to fourth, not quite so prominent or so strongly sclerotized. Plates as in most other species, those between the 3 pairs of fully developed lobes rather slender and with roughly parallel sides, strongly fimbriate at apices, but usually with one projection longer and more prominent than the others, the 3 plates between third and fourth lobes broad, especially the intermediate plate, and similarly fimbriate along apical margin; 3 of the 4 plates between fourth and fifth lobes also broad, but the fimbriations fewer, shorter, and stouter, the fourth plate more slender; plates continued to posterior corner of first abdominal segment, mostly short, stout at base, rounded, tapering to a single projection of moderate length. Paragenitals relatively few in number, characteristically in 4 groups; tabulated range for anterior paragenitals 5 to 8, average 6.5; for posterior paragenitals 5 to 9, average 6.6; totals, range 23 to 29, average 24.6.

Because of the uncertainties associated with some of the host records published for this insect, no attempt is made here to summarize such published information. Large host lists for *pergandii* have been given by Merrill and Chaffin (*45, p. 246*) and by Kuwana (*31, p. 10*), and Merrill and Chaffin also give the recorded world distribution up to time of publication. The species readily establishes itself on citrus fruits, and because of this has been intercepted repeatedly by the plant quarantine inspection service of this Department.[8] The distribution records of specimens from *Citrus* species and varieties (Rutaceae) that have been examined in the course of this study include the following: From the United States: Alabama, California, Connecticut, District of Columbia, Florida, Louisiana, Maryland, Mississippi, New York, North Carolina, Ohio, Pennsylvania, Texas, and Virginia (the records for the Northern States obviously are for greenhouse infestations, or from fruit shipped into the State). From other parts of continental North America: Canada, Canal Zone, Guatemala, Honduras, Mexico, Nicaragua, and Panama. From the West Indies: Cuba, Dominica, Dominican Republic, Grenada, Isle of Pines, Jamaica, Puerto Rico, St. Kitts, St. Lucia, St. Vincent, and Trinidad. From South America: Argentine, British Guiana, Brazil, and Ecuador. From Europe: Greece, France, Italy, Yugoslavia, Malta, Portugal, Sicily, and Spain (other European quarantine records rather certainly involve fruits not produced in country indicated as source). From the Asiatic area: Burma, China, Chosen, India, Japan, Java, Palestine, Philippine Islands, Siam, Straits Settlements, Sumatra, and Syria. From Africa: Algeria, Egypt, South Africa, Libya (Tripoli), and West Africa. Additional material on *Citrus* came from Australia, New Zealand, and from various islands including Bermuda, Canary Islands, and Hawaii. Specimens examined from hosts other than *Citrus* include some on *Aucuba* (Cornaceae) from Japan; on *Buxus* (Buxaceae) from Mississippi and Louisiana; on *Elaeagnus* (Elaeagnaceae) from Louisiana; on *Euony-*

[8] See comments on validity of such records in footnote 4.

mus (Celastraceae) from Louisiana, Mexico, Mississippi, Spain, and Texas; on *Garcinia morella* (Guttiferae) from Cuba; on black grapes (Vitaceae) from Argentina; on *Jasminum undulatum* (Oleaceae) from China; on *Jasminum* sp. from the District of Columbia; on *Myrtus communis* (Myrtaceae) from Dominica; on palms (Palmae) from Italy and Pennsylvania; on *Severinia buxifolia* (Rutaceae) from Honduras; on *Tutcheria spectabilis* (Ternstroemiaceae) from England; and on *Yucca* (Spanish bayonet) (Liliaceae) from Louisiana.

As was indicated in the morphological discussion, specimens that exhibit considerable differences in the apparent size of the three pairs of fully developed pygidial lobes have been placed as this species. However, there seems to be complete intergradation in this size factor, and no other parallel structural variations that might indicate the desirability of further segregation have been noted in the specimens studied. The absence of the small dermal pocket outside the posterior spiracles, apparently constant in all specimens in which the area could be examined adequately, is a characteristic that fully distinguishes *pergandii* from all those forms which have been placed in association with it except *pittospori*. The latter species also lacks the pocket, but has conspicuous dorsal intermediate macroducts and has a fourth lobe resembling the adjacent plates, although not so large as these.

PARLATORIA PITTOSPORI Maskell

(Pl. 5, *A*; pl. 9, *A*; pl. 11, *C*)

This insect was first described by Maskell (*37*, *p. 11*) in 1891, and does not seem to have been again recognized in the field, although it is included in various lists and catalogs. From specimens from the Maskell collection of Coccidae it has been possible to fix definitely the characteristics of the species, and material from this collection and from other sources has led to the establishment of the synonymy detailed below. In the same paper Maskell (*37*, *p. 12*) described another Australian species under the name *myrtus*. Specimens from the lot so named in his collection, on comparison, prove to be specifically identical with those from the *pittospori* lot. There exists, of course, the possibility that these lots of specimens became confused either during the original installation in the collection or during its subsequent handling, and that Maskell actually had two species before him, but on the evidence available it is necessary to place *myrtus* as a synonym of *pittospori*. Later, in 1897, Fuller (*22*, *p. 1344*) listed two new species of *Parlatoria* from Western Australia, for one of which, *dryandrae*, a slide marked "type" has been available for examination. This slide bears only immature stages and in consequence is not wholly satisfactory for purposes of comparison. Fortunately, it has been supplemented by specimens collected by George Compere from the type host, *Dryandra*, and from the general type locality, Swan River, Western Australia, which aid in confirming the conclusion that *P. dryandrae* Fuller is specifically identical with *P. pittospori* Maskell.

Still later, in 1899, Fuller (*23*, *p. 468*) described one more new species of *Parlatoria*, *petrophilae*, from Western Australia, without specific locality, on *Hakea ilicifolia* and *Petrophila linearis*. No

Fuller material of this insect has been available for study, but again, thanks to George Compere's collecting, specimens from both the type hosts from Western Australia, as well as from other hosts in Australia, have been studied with the resultant conclusion that the name *petrophilae* Fuller can properly be included as one of the synonyms of *pittospori* Mask.

Adult female.—Eyespot small but usually distinct, approximately circular, more or less protruding to almost stout conical. Each anterior spiracle with 2 to 5 disk pores adjacent, average number in specimens tabulated 2.6; posterior spiracle without derm pocket between spiracle and margin and, so far as noted, without tubular ducts near spiracle in this area. Duct tubercles of medium size, ranging from rather acutely short conical anteriorly to elongate and hardly conical posteriorly; numbers in the specimens tabulated as follows: Prespiracular, range 2 to 6, average 4; anterior spiracular, range 3 to 12, average 5.65; intermediate, range 1 to 8, average 3.1; posterior spiracular, range 1 to 7, average 2.3; first abdominal, range 1 to 7, average 4; totals, one side of body, range 10 to 24, average 21. Dorsal submarginal tubular ducts intermediate in number, tabulated range for each side of body 35 to 68, average, in specimens examined critically, 43. No cicatrices observed on dorsum of first abdominal segment. No special sclerotic flecks noted on pygidium. Both macroducts and microducts on intermediate dorsal areas of pygidium, usually 1 to 4 macroducts above each anterior lateral paragenital pore cluster, and 1 to 5 on segment immediately preceding this, sometimes with 1 to 3 smaller macroducts on segment anterior to this; or with microducts at this point and in varying numbers on anterior abdominal segments, also sometimes between intermediate ducts of each segment; very rarely with a duct on each side on pygidium within frame of paragenitals. The three median pairs of lobes fully developed as usual, moderate in size, graded somewhat in size from median to outer, all usually more or less distinctly notched on both inner and outer margins; fourth and fifth lobes represented by membranous extensions of pygidial margin closely simulating the adjacent plates as in *proteus*, but varying considerably in size, shape, and extent of fimbriation in the specimens examined. Plates between the fully developed lobes and beyond these to fifth lobe much as in other species; those beyond fifth lobes broad toward base, tapering toward apex, but each usually with basal constriction and irregularly truncate apex. Paragenitals fairly numerous, in 4 groups, adjacent ends of 2 groups on each side often close together; pore numbers in material studied critically: Anterior laterals 6 to 18, average 10; posterior laterals 7 to 15, average 11.25; totals 35 to 61, average 43.3.

The preceding conclusions on synonymy and the descriptive notes have been based on a considerable accumulation of specimens, the bulk of which come from the extensive coccid collections presented to the Bureau of Entomology by George Compere in 1911. Most of the specimens studied are from Australia and include examples from Maskell's type material of *pittospori* (Maskell collection No. 123) and of *myrtus* (Maskell collection No. 136) and immature specimens from the type material of Fuller's *dryandrae*. Material from other sources includes specimens on *Pittosporum undulatum* (Pittosporaceae), Australia, Koebele collection, Myrniong, Victoria, September 1899, J. Lidgett (No. 191); *Pittosporum* sp., Sydney (No. 392), West Maitland, New South Wales (No. 629), Norova, New South Wales (No. 659), Perth, Western Australia (No. 2022); on *Banksia* sp. (Proteaceae), Swan River, Western Australia (Nos. 806 and 933); on *Dracaena draco* (dragon's blood tree) (Liliaceae), Sydney (No. 254); on *Dryandra* sp. (Proteaceae), Swan River, Western Australia (No. 871); on *Hakea* sp. (Proteaceae), Albany (No. 1009), Swan River, Western Australia (No. 807), and unspecified locality (No. 873); on laurustinus (*Viburnum tinus*) (Caprifoliaceae), Sydney (No. 238), all collected by George Compere; on *Macrozamia corallipes* (Cycada-

ceae, from Sydney, collected at quarantine, District of Columbia, W. B. Wood, 1935 (E. Q. No. A31696); on *Melaleuca* sp. (Myrtaceae) (No. 955) and *Nuytsia floribunda* (Loranthaceae) (No. 944), Swan River, Western Australia, both collected by George Compere; on *Mimosa* (Leguminosae), Freemantle, 1900, collected by Koebele; on *Petrophila linearia* (Proteaceae), Perth, Western Australia (No. 873), collected by George Compere; on *Pimelea linifolia* (Thymelaeaceae), Victoria, 1899, collected by Lidgett; on *Pinus halepensis* (Pinaceae) in park, Warwick, Queensland (from plant specimen in Arnold Arboretum herbarium); *P. insignis*, Perth, Western Australia, 1897, collected by Fuller (this is *P. proteus* of Fuller (*22, p. 1344; 23, p. 466*)); on *Xanthorrhoea* (grass tree, Liliaceae), Sydney (No. 315), collected by George Compere. In addition, several lots of Australian specimens without positive host association have been examined. One of these, on "box hedge." Richmond, New South Wales, Froggatt (No. 28), requires particular mention, as it was previously supposed to be *P. proteus*.

In addition to the Australian material, recorded above, specimens of this insect have been examined that were collected at quarantine in the United States, one lot from New Zealand on *Pyrus malus* (Rosaceae), at New York City, by Fox, Dodd, and Kostal, 1934 (N. Y. No. 22995), and one from Stellenbosch, South Africa, on *Haworthia neilii* (Liliaceae), at Washington, D. C., by Limber in 1936 (E. Q. A34027).

PARLATORIA PROTEUS Curtis

(Pl. 5, *B*; pl. 9, *B*; pl. 11, *D*)

No types of this species have been available, and the concept here presented is based on an examination of specimens from orchidaceous and other hosts from many parts of the world. Curtis (*48, p. 676*) first described the insect in 1843, reporting its occurrence in greenhouses in England on succulent leaves of a plant, perhaps an *Aloe* or *Amaryllis*. It was first recognized in this country by Comstock (*13, p. 114*), who recorded its presence in the Department of Agriculture greenhouses in Washington on *Macrozamia*.[9] Subsequent publications have reported this insect from widely scattered localities throughout the world. Undoubtedly many of these records refer to other forms as recognized in this publication. For example, the status of Fuller's record of *proteus* from pine in Western Australia has been discussed previously under *pittospori*, and Hall (*26, p. 51*) has called attention to the inaccuracy of older records for the occurrence of *proteus* in Egypt. Probably it will never be possible to check the correctness of all these published records. In view of this actual and probable confusion the published records for the host association and distribution of *proteus* are not summarized here.

Several forms have been variously placed as varieties or synonyms of *proteus*. Of these, *crotonis* Dougl. and *pergandii* Comst. are here accepted as valid and distinct species, *palmae* Mask. is placed as a

[9] The original publication of this record reports the host plant as *Microsamia*. From consultation with botanists of the Department of Agriculture and their examination of a portion of the host material from the original collection, it appears (1) that *Microsamia* has had no standing as the name of a genus of living plants, and (2) that the host may well have been a species of *Macrozamia*. It is therefore concluded that the name "*Microsamia*" is either a typographical error or may have been copied from an incorrectly spelled name attached to the host plant.

synonym of *blanchardi* Targ., and lack of adequate material precludes comment on *phyllanthi* Green (*25, p. 350*) and *virescens* Mask. (*39, p. 300*). Specimens of *mytilaspiformis* Green (*24, p. 164*) from *Psychotria thwaitesii*, Pundaluoya, Ceylon, August 1898, presumably part of the type material, and of this insect as reported from tea plant by Green, collected in the Udagama district, Ceylon, October 1898, from lots presented to the collections by E. E. Green many years ago, have been examined. From this examination it is concluded that the specimens from tea plants exhibit characters coming within the limits of *proteus* as here recognized, but that the specimens from *Psychotria* are plainly different, lacking the spurs near the body margin opposite the anterior spiracles, the membranous pocket between posterior spiracles and margin, and microducts on the dorsum of the pygidium above the anterior lateral paragenitals; in addition, the submarginal dorsal tubular ducts are considerably more numerous, averaging around 35 to 40 in the specimens examined. Although *mytilaspiformis* is thus established as distinct from *proteus*, and likewise appears to be distinct from the other species included in this publication, its relationship to the remaining species or varieties described in *Parlatoria* cannot be definitely settled at this time.

Adult female.—Eyespot appearing as a triangular spur, usually strongly developed but sometimes weak. Anterior spiracles with 1 to 3 disk pores adjacent to each, usually, however, with 2 such pores; posterior spiracles with a relatively distinct and conspicuous derm pocket about halfway to the body margin. Duct tubercles comparatively small and inconspicuous, stout conical, more slender posteriorly; numbers on each half of body as follows: Prespiracular, usually 1, range 1 to 3, average 1.2; anterior spiracular, range 0 to 4, average 1+; intermediate, range 0 to 6, average 3.2; posterior spiracular, range 2 to 7, average 4; first abdominal, range 2 to 6, average 3.3; totals, range 7 to 25, average 12.3. Dorsal submarginal tubular ducts moderate in number, the observed range 11 to 25 for one side of body, with an average around 18. No dorsal intermediate macroducts, but one cluster of microducts on each side immediately above anterior lateral paragenital cluster and another along anterior edge of general dorsal thickening of pygidium, the first-mentioned cluster ranging from 1 to 5 in number, the second from 3 to 7. No constantly occurring cicatrices noted on abdominal dorsal segments, and no constant tiny sclerotic flecks observed on dorsum of pygidium. The 3 developed pairs of lobes small, almost equal in size to somewhat graduated, lightly notched on both inner and outer margins, inner margin of third lobe usually hardly more than sinuate; fourth and fifth lobes represented by projections of pygidial margin that closely simulate adjacent plates but are usually smaller and somewhat variable in details of outline, basal constriction, and extent of fimbriation. Plates between lobes much as in other species, those outside of third lobes up to fifth lobes broad and short in comparison with those of some other species. Paragenitals, as far as observed, constantly in 4 small groups, exhibiting some variation in number of pores in each group, in the material critically examined showing a range in anterior laterals of 3 to 8, average 6; in posterior laterals of 3 to 6, average 5; totals, range 17 to 26, average 21.

This species, as here recognized, has a wide distribution and a considerable variety of host-association records. The bulk of the records for which material has been examined fall in two plant families, Orchidaceae and Palmae, and on this account most of the records listed below have been grouped by plant family. Specimens placed as this species have been examined in Orchidaceae on various species of *Aerides* from England, France, Philippine Islands, Java, and India; on *Arachnante rosea* from Straits Settlements; on various species of *Brassia* from Dutch Guiana; on various species of *Cattleya* from Louisiana; on *Coelogyne flaccida* from District of

Columbia; on *Cymbidium* species from England and India; on various species of *Cypripedium* from District of Columbia, England, Guatemala, Hawaii, Louisiana, Massachusetts, and Philippine Islands; on various species of *Dendrobium* from Belgium, District of Columbia, England, Guatemala, Java, Louisiana, New Jersey, and New York; on various species of *Epidendrum* from Philippine Islands; on *Grammatophyllum speciosum* from Java; on *Maxillaria tenuifolia* from District of Columbia; on "orchid" from Brazil, Ceylon, Cuba, District of Columbia, Dominican Republic, Dutch Guiana, England, Florida, Guatemala, Hawaiian Islands, India, Japan, New Jersey, New York, Philippine Islands, Siam, and Venezuela; on various species of *Phalaenopsis* from England and Japan; on various species of *Renanthera* from China and Philippine Islands; on *Rhyncostylis retusa* from India and Java; on various species of *Saccolabium* from India and Siam; on *Schomburgkia lyonsi* from Jamaica; on *Sterochilus fasciata* from England; on *Trichocentrum allopurpurem* from England; on various species of *Vanda* from Belgium, Ceylon, District of Columbia, England, France, India, Indiana, Japan, Java, Philippine Islands, and Sumatra. In the Palmae specimens have been examined on *Areca* sp. from Louisiana; on various species of *Cocos* from Florida and Louisiana; on various species of *Cocothrinax* from Florida; on various species of *Kentia* from Brazil, District of Columbia, Japan, and Maryland; on "palm" from Brazil, China, Cuba, District of Columbia, Florida, Haiti, India, Louisiana, Malay Peninsula, Mississippi, New York, and Philippine Islands; on *Phoenix dactylifera* from District of Columbia; on various species of *Sabal* from Florida and India; and on various species of *Thrinax* from District of Columbia. Other plant families represented by more than one host genus include: Family Araceae, on various species of *Aglaonema* from Philippine Islands, on *Diffenbachia sequine* from Japan, on *Monstera deliciosa* from Florida, on *Philodendron* from District of Columbia; family Cycadaceae, on various species of *Cycas* from Bahamas, China, Cuba, District of Columbia, Maryland, and on *Macrozamia* sp. from District of Columbia; family Liliaceae, on *Aspidistra* from Pennsylvania, on *Sanseviera* from Maryland and California, and on *Yucca* from Panama. Other records for material studied include specimens on *Agave* (Amaryllidaceae) from Kansas; on *Amomum* (Zingiberaceae) from District of Columbia; on *Billbergia* (Bromeliaceae) from British Guiana; on various species of *Citrus* (Rutaceae) from China, Philippine Islands, Straits Settlements, and Sumatra; on fern (Filicales) from Jamaica; on *Ficus* (Moraceae) from Cuba, District of Columbia, Kansas, Louisiana, Maryland, Philippine Islands, and Texas; on *Hedera* (Araliaceae) from Louisiana; on *Mangifera indica* (Anacardiaceae) from Brazil, Haiti, Jamaica, and Straits Settlements; on *Maranta massangeana* (Marantaceae) from Georgia; on *Philadelphus* (Saxifragaceae) from China; on *Quercus* (Fagaceae) from Texas; and on *Thunbergia* (Acanthaceae) from Florida. In addition, specimens from unrecognized hosts have been examined from Brazil, Ceylon, China, Cuba, Guatemala, Hawaii, India, Japan, Louisiana, New York, Philippine Islands, and Trinidad.

PARLATORIA THEAE Cockerell

(Pl. 6, *A*; pl. 9, *C*; pl. 11, *E*)

First described in 1896 by Cockerell (*6*, *p. 21*; *7*, *p. 55*), this insect and its two supposed varieties *viridis* Cockerell (*6*, *p. 21*) and *euonymi* Cockerell (*8*, *p. 591*) have received occasional mention in literature, usually in lists or reports of quarantine interceptions. Probably the most important of these references is the discussion by Kuwana (*31*, *p. 12*), which indicates clearly the common identity of the species and its two supposed varieties, brings out the distribution, host associations, and importance of the insect in Japan, and presents studies emphasizing the variability of the paragenitals, structures used in part by Cockerell as a basis for his varieties. It seems rather surprising, in view of Kuwana's illustrations and description, that Lindinger (*35*, *p. 150*) should place this insect and its varieties in synonymy under *Parlatoria oleae*. The two actually are quite distinct. Ferris (*20*, *p. SI.–88*) expresses the opinion that Kuwana's figures for *theae* represent instead the species *pergandii*, but this study does not support such a conclusion. One difference alone, the large number of paragenitals shown in the figure, is sufficient, in the face of the existence of a Japanese species distinct from *pergandii*, to remove the Kuwana illustrations from the suspicion of incorrect identification.

Adult female.—Eyespot present but small, usually distinct, and when well developed appearing in profile as a small hemispherical to short cylindrical projection from the body surface. Anterior spiracles in material examined critically with 2 to 5 disk pores adjacent, mostly with 2 or 3; posterior spiracles with a small but distinct invaginated derm pocket located near each spiracle at a point about one-fourth to one-third the distance between spiracle and body margin. Duct tubercles rather numerous, small, short, rounded conical; numbers for one side of body, prespiracular, range 0 to 7, average 3.25; anterior spiracular, range 1 to 11, average 4.25; intermediate, range 3 to 12, average 8; posterior spiracular, range 3 to 14, average 7.85; first abdominal, range 2 to 12, average 6.5; totals for one side of body, range 16 to 49, average 30. Dorsal submarginal tubular macroducts usually fairly abundant but variable; range for one side of body 26 to 95, average about 51. A single tiny, inconspicuous, but apparently distinctly and rather consistently developed, oval sclerotic fleck near margin dorsally between third and fourth abdominal segmental lobes. Without dorsal intermediate macroducts; microducts in this area apparently confined to a few above anterior lateral paragenitals, ranging from 0 to 4 in number, which may be wholly lacking more often than they are present, and to a strong cluster in margin of pygidial thickening anterior to paragenitals, this cluster apparently always present on each side of body. Number of ducts ranging from 3 to 12, with an average of about 6, to the cluster, sometimes in addition with 1 or 2 similar ducts between the 2 clusters at or close to the midline of the body. Lobes rather small in relation to size of insect, but well developed and normally definitely though not conspicuously graded in size from median to third, normally distinctly notched on both inner and outer margins; fourth lobes and, to a lesser degree, fifth lobes represented by small angular projections of pygidial margin, each ending in a point and without or with 1 or more tiny teeth along edges; fourth lobes distinctly sclerotized, fifth lobes only lightly. Plates between fully developed lobes slender; those between third and fifth lobes much broader, all these distinctly but not conspicuously fimbriate along apical margins; those beyond fifth lobes short, broad at base, tapering to a rounded or truncate tip, not fimbriate, but with 1 or 2 projecting fingers. Paragenitals rather numerous but variable, mostly in 4 groups but occasionally with an anterior median group of 1 to 5 pores also present; in material critically examined, anterior median, present in 10 percent of specimens, range 0 to 5; anterior laterals, range of one group 5 to 24 pores, average

15.2; posterior laterals, range of one group 7 to 20, average 13.5; totals per specimen, range 25 to 84, average 58.[10]

The distribution of *theae*, as reported in the literature examined, includes only Japan and the United States, but study of material received for identification has added China, Chosen, England, and the Philippine Islands (the first and the last two quarantine-interception records). Within the United States the distribution is still restricted to a few isolated localities, but unfortunately the species appears to be rather widely scattered over the country. Specimens have been examined from California (a quarantine interception at New York City), District of Columbia, Georgia, Maryland (at a plant introduction garden), Texas, and Virginia (perhaps only on newly imported host trees). In addition, there is an unverified record for the species from New York State by Felt (*18, p. 202*) and one from Missouri by Hollinger (*28, p. 35*), the latter record perhaps relating to specimens from newly imported plant host material.

The assembled host records include a considerable variety of plants, mostly representing woody tree and shrub genera. In Japan the species is regarded as a definite pest, and the possibilities for the United States, if the species maintains its present foothold and eventually widens its distribution, are indicated from the information obtained several years ago as a result of a survey of the National Botanic Garden in Washington, D. C. In the course of this examination, plant-quarantine inspectors found the species established out of doors on about 16 host species or varieties representing 9 genera and 8 families.

Published discussion furnishes the following records for this species, most of which will be found in the paper by Kuwana (*31, p. 15*) on Japanese *Parlatoria* or in that by Clausen (*5, p. 11, 27, 38, 41, 77, 83*) on injurious Japanese insects: On *Acer* (*Aceraceae*) from Japan, New York, and Missouri; on *Aucuba* (Cornaceae) from District of Columbia; and on *Citrus* (Rutaceae), *Cornus* (Cornaceae), *Diospyros* (Ebenaceae), *Elaeagnus* (Elaeagnaceae), *Euonymus* (Celastreaceae), *Eurya* (Theaceae), *Hibiscus* (Malvaceae), *Ilex* (Aquifoliaceae), *Osmanthus* (Oleaceae), *Podocarpus* (Taxaceae), *Poncirus* (Rutaceae), *Pyrus* (apple and pear) (Rosaceae), *Rosa* (Rosaceae), *Thea* (Theaceae), *Viburnum* (Caprifoliaceae), and *Vitis* (Vitaceae) from Japan.

During this study specimens placed as *theae* have been examined from the following hosts and localities: On several species of *Acer* (Aceraceae) from Chosen, District of Columbia, England, Japan, and Virginia; on *Aucuba* (Cornaceae) from California, China, District of Columbia, Georgia, and Japan; on *Celtis* (Ulmaceae) from Texas; on *Citrus* (Rutaceae) from Japan; on *Codiaeum* (Euphorbiaceae) from Japan; on several species of *Cornus* (Cornaceae) from District of Columbia; on *Crataegus* (Rosaceae) from China; on *Diospyros* (Ebenaceae) from Japan and Maryland (at plant intro-

[10] An analysis of the figures for paragenitals in 53 specimens given by Kuwana (*31, pp. 14–15*) shows, for the anterior median cluster, occurrence in about 20 percent of the specimens with a range of 0 to 7 pores; for one cluster of the anterior laterals a range of 9 to 27, with an average of 16.7 pores; for one cluster of the posterior laterals a range of 8 to 22, with an average of about 14.3 pores; totals, range 35 to 78, with average of 62.5 pores.

duction garden); on *Enkianthus* (Ericaceae) from Japan; on *Euonymus* (Celastraceae) from Japan and Philippine Islands; on *Hibiscus* (Malvaceae) from Chosen, District of Columbia, and Japan; on *Euphorbia poinsettia* (Euphorbiaceae) from Japan; on *Prunus* (plum, cherry, peach) (Rosaceae) from Chosen and Japan; on *Pyrus* (pear) from Chosen, China, and Japan; on *Rosa* (Rosaceae) from District of Columbia; on *Staphylea* (Staphyleaceae) from District of Columbia; on *Syringa* (Oleaceae) from District of Columbia; on *Thea japonica* (Theaceae) from District of Columbia; on *Thea sinensis* from Japan; and on *Viburnum* (Caprifoliaceae) from District of Columbia and Japan.

PARLATORIA ZIZYPHUS (Lucas)

(Pl. 6, *B*; pl. 9, *D*; pl. 11, *F*)

The species here discussed as *zizyphus* is that one recognized under this name by working coccidologists throughout the world, although the original description by Lucas (*36*, *pp. xxviii–xxix*) is so brief and indefinite that there is legitimate question as to the correctness of the association of the name and the common black citrus-infesting *Parlatoria*. In literature the insect has been recorded from a few hosts in addition to various species and varieties of *Citrus*, but all these records that have been examined may be questioned as possible misidentifications, further strengthening the suspicion that Lucas' name and description may not actually apply to this insect.

From present knowledge of the genus, this insect is so readily distinguished from the other included species that it has not seemed necessary to tabulate the quantitative characters for a long series of specimens. In consequence the figures given in the following descriptive notes have been taken from a few, apparently average, specimens. No doubt this species will exhibit the same tendency toward quantitative variation that has been shown by the species which have been subjected to extensive and detailed tabulation.

Adult female.—Eyespot relatively large and especially conspicuous owing to placement at apex of a prominent, globular to somewhat elongated protuberance of body margin, this protuberance very rarely reduced to a conspicuous rounded cone. Anterior spiracle with 2 to 4 pores adjacent; posterior spiracle without trace of dermal pocket. Duct tubercles: None opposite anterior spiracles or before these; 3 to 6 small, inconspicuous, short, rounded conical ones on body margin between anterior and posterior spiracles, 7 to 9 along margin opposite posterior spiracle, and 4 on margin of first abdominal segment. Dorsal submarginal tubular ducts few, 10 to 14, the reduction in number being chiefly on anterior abdominal segments. A small oval cicatrix usually visible on each side of abdomen, apparently along anterior margin of second abdominal segment, but not observed in some of the specimens examined. No isolated sclerotic flecks observed on pygidium. Without dorsal intermediate macroducts, usually without but occasionally with a single intermediate microduct above anterior lateral paragenital pore cluster. The 3 pairs of normally developed lobes small, slender, practically equal in size, faintly notched on both inner and outer margins; fourth lobes likewise slender, strongly protruding, suggesting a sclerotized spur; no trace of a sclerotic structure at point where fifth lobes would occur. Plates between lobes slender, much as in other species; those between third and fourth lobes and just beyond fourth lobes broadened, oval, but strongly fimbriate along outer margin; intermediate plate between third and fourth lobes widest, but not approaching condition in some other species; remaining plates elongate-oval to irregularly lanceolate, strongly

fimbriate outwardly; all plates beyond third lobes evidently constricted at base. Paragenitals in 4 groups, few in number, anterior laterals about 5, posterior laterals about 10 in each cluster.

The conspicuous lateral prosomal lobe and the black scale provide ready and apparently distinctive recognition characters for this insect, and the spurlike fourth pygidial lobe and the much reduced duct tubercles, lacking opposite and in front of anterior spiracles, also contribute to its easy identification.

Specimens of this insect from various species and varieties of *Citrus*, mostly obtained from quarantine interceptions, have been examined as follows: In the European area from France, Greece, Italy, Malta, Portugal, Sicily, and Spain; in northern Africa from Algeria, Egypt,[11] and Morocco; in the Asiatic area from Burma, Caucasus, China, Taiwan (Formosa), Indo-China, Japan, Java, Philippine Islands, Straits Settlements, and Sumatra; in the New World from Cuba, Dominica, and Haiti; and one record each from Mississippi, Hawaii, and New Zealand.

LIST OF SPECIES DESCRIBED AND THEIR SYNONYMS

banksiae (Maskell)
blanchardi (Targioni Tozzetti)
Syn., *proteus palmae* Maskell
victrix Cockerell
camelliae Comstock
cinerea Hadden
Syn., *fluggeae brasiliensis* Costa Lima
pseudopyri Kuwana
crotonis Douglas
fulleri Morrison, new name for *viridis* Fuller
oleae (Colvée)
Syn., *affinis* Newstead
calianthina Berlese and Leonardi
pergandii Comstock
Syn., *sinensis* Maskell
pittospori Maskell
Syn., *dryandrae* Fuller
myrtus Maskell
petrophilae Fuller
proteus (Curtis)
theae Cockerell
Syn., *theae euonymi* Cockerell
theae viridis Cockerell
zizyphus (Lucas)

Contrary to the currently accepted view, authentic specimens of *Parlatoria mytilaspiformis* Green are found not to be examples of the species *proteus* as this is at present recognized.

[11] This record is based on specimens taken at quarantine in Boston from orange leaves in 1924 by C. A. Davis (Boston No. 876) and from pomelo in 1933 by O. A. Hardy (Boston 8875). Hall (27, *p.* 22) states that it had not been found in Egypt up to the time of publication of his paper. Comment on the validity of *Citrus* quarantine records made under *P. cinerea* should be noted.

KEY TO SPECIES OF PARLATORIA HEREIN DESCRIBED

a. No duct tubercles on anterior portion of body, opposite anterior spiracles, or before these; eyespot large and conspicuous; submarginal dorsal tubular ducts very few, probably not exceeding 15 on each side of body; no dorsal intermediate macroducts; microducts, if present in this area, very few and inconspicuous.

b. No duct tubercles present on any part of body; eyespot a large, circular, sclerotized area on surface of body; fully developed pygidial lobes entire, or at most only very slightly notched or sinuate laterally; no definitely formed fourth lobe, at most a blunted extension of body margin ..... *blanchardi* (Targ.)

bb. With duct tubercles on body margin between anterior and posterior spiracles, opposite posterior spiracles, and on first abdominal segment, but these small and inconspicuous; eyespot large but set at apex of a conspicuous globular to somewhat elongated projection of body margin; fully developed pygidial lobes distinctly notched laterally; fourth lobe represented by a stout and conspicuous sclerotized spur ..... *zizyphus* (Lucas)

aa. With duct tubercles, often numerous and usually conspicuous, on body margin opposite anterior spiracles, and before these; eyespot various, sometimes difficult or impossible even to locate, but not as above described; submarginal dorsal tubular ducts numerous to very numerous according to the species, 20 to 100 or more, except in *proteus*, this with as few as 10; with some dorsal intermediate macroducts or, more often, with 2 or more segmental rows of microducts in this area, these occasionally much reduced in number or even lacking.

c. Normal specimens without a marginal tubular macroduct between median lobes of pygidium, these lobes relatively close together and strongly crowding the very slender interlobular plates; eyespot tiny but distinct; with dorsal intermediate and median macroducts on abdomen; median and second lobes large, conspicuous, strongly protruding, once notched externally; paragenitals in 5 groups, very numerous, 85 to 113 ..... *banksiae* (Mask.)

cc. Normal specimens with a marginal tubular macroduct between median lobes of pygidium; other characters various but not in preceding combination; paragenitals mostly in 4 groups and probably never over a total of 60, except in *oleae*, this usually with 5 groups and from 60 to 100 pores, and *theae*, this occasionally with an anterior median group of 1 to 5 pores.

d. Intermediate marginal plate between third and angular sclerotized fourth pygidial lobes deeply cleft, giving an appearance of 4 distinct and rather slender plates between these lobes, instead of usual 3 plates with intermediate one wide; paragenitals usually in 5 groups (the anterior median, however, sometimes lacking), numerous, usually totaling 70 or more; with dorsal intermediate macroducts, mostly in 3 segmental rows on each side of abdomen; without an invaginated membranous pocket in derm between posterior spiracle and body margin; eyespot inconspicuous; submarginal tubular ducts numerous, usually 60 or more on each side of body; median and second lobes especially large, prominent, their external notch deep and conspicuous ..... *oleae* (Colvée)

dd. Intermediate marginal plate between third and fourth pydigial lobes never cleft in normal specimens, and usually the largest plate on pygidial margin; paragenitals usually in 4 or fewer groups (sometimes in 5 groups in *theae*) (isolated stray pores, apparently belonging with nearest pore cluster, noted occasionally); other characters not in above-described combination.

e. Several, generally a total of 6 to 8, dorsal macroducts showing on pygidium within frame formed by paragenital pore clusters, usually as a row of 3 or 4 on each side of anal opening; fully developed pygidial lobes large and strongly protruding, strongly graded in size from inner to outer, each characteristically twice or even thrice notched on outer side; fourth lobe a short, broad, more or less sclerotized extension of pygidial margin, usually showing several small

apical teeth of approximately equal size but with none of these conspicuously larger and more prominent; pygidial and lateral marginal plates mostly tapering and ending in one conspicuously elongate extension; dorsum of pygidium on each side, in addition to sclerotization associated with duct openings, with 3 small, oval, independent sclerotized flecks, 1 anterior to fourth lobe and 1 in corresponding position on 2 segments preceding this ..... *cinerea* Hadden

ee. Normally without dorsal pygidial macroducts within frame of paragenitals; if present through variation or abnormality, then other characters not in above combination; pygidial lobes less prominent, once notched externally; fourth lobe various; plates not elongate tapering as in *cinerea;* without or, at most, with only a single, tiny sclerotic fleck near pygidial margin dorsally.

f. Abdomen with dorsal intermediate macroducts above anterior paragenitals and on segment anterior to these, sometimes, in addition, on the second segment anterior to these, and, rarely, within the frame of the paragenitals as well; no invaginated membranous derm pocket outside of each posterior spiracle; fourth lobes represented by an unsclerotized projection much resembling adjacent plates ..... *pittospori* Mask.

ff. Normally without dorsal intermediate macroducts on pygidium; if present through variation or abnormality, then other characters not in above-described combination.

g. Without an invaginated membranous pocket in ventral derm between posterior spiracle and body margin; eyespot small, inconspicuous, often difficult to locate; fourth lobe a fairly broad sclerotic projection of pygidial margin with teeth along outer margin, one of which characteristically is conspicuously larger than the others, and may be so developed as to transform the lobe into a short, broad, sclerotized spur ..... *pergandii* Comst.

gg. With a small, but distinct, invaginated membranous pocket in ventral derm between each posterior spiracle and body margin; fourth lobe various, but not exactly as in preceding.

h. Eyespot modified to form a stout spur, projecting from body margin or placed close to margin (must be differentiated from adjacent, often very similar, duct tubercles); without small isolated sclerotized flecks on dorsum of pygidium.

i. Fourth lobe a membranous projection of pygidial margin closely simulating adjacent plates in structure and appearance, although usually much smaller ..... *proteus* (Curt.)

ii. Fourth lobe slender, almost spurlike, definitely sclerotized ..... *crotonis* Dougl.

hh. Eyespot various, flat, irregular, sometimes almost hemispherical, and sometimes so obscure as to appear lacking, but in no case appearing as a strong spur on or near body margin; in 2 or 3 species with a tiny circular to oval sclerotized fleck anterior to fourth lobe or near margin between third and fourth abdominal segments, the third species with paragenitals normally in 2 instead of 4 groups.

j. Fourth lobe developed as a more or less strongly sclerotized projection of pygidial margin; paragenitals normally in 4 distinctly separated groups; normally with microducts above anterior paragenitals and at anterior margin of dorsal sclerotized area of pygidium; with a tiny sclerotic fleck on pygidium as above described.

k. Submarginal tubular ducts relatively few, 20 to 29 per side; fully developed pygidial lobes almost equal in size, third, or outer, pair very little smaller than median pair; paragenitals few in number, 19 to 31 in material studied; pygidial sclerotic fleck anterior to fourth lobe_ *camelliae* Comst.

kk. Submarginal tubular ducts usually relatively numerous, averaging around 51, but ranging from 26 to 95 in material tabulated; fully developed pygidial lobes obviously graded as in *pergandii*, third, or outer, pair definitely smaller than median pair; paragenitals relatively numerous, total averaging around 60, but ranging from 25 to 84 in material studied; pygidial sclerotic fleck in interspace between third and fourth segments_____ *theae* Ckll.

jj. Fourth lobe practically indentical in appearance with adjacent plates; posterior and anterior groups of paragenitals normally fused into a single band on each side of vaginal opening, but this band narrowed near its middle; normally without microducts above anterior paragenitals or along anterior edge of pygidial sclerotized area, but such tiny ducts present on anterior abdominal segments; no sclerotic flecks on pygidium_____ *fulleri* Morrison

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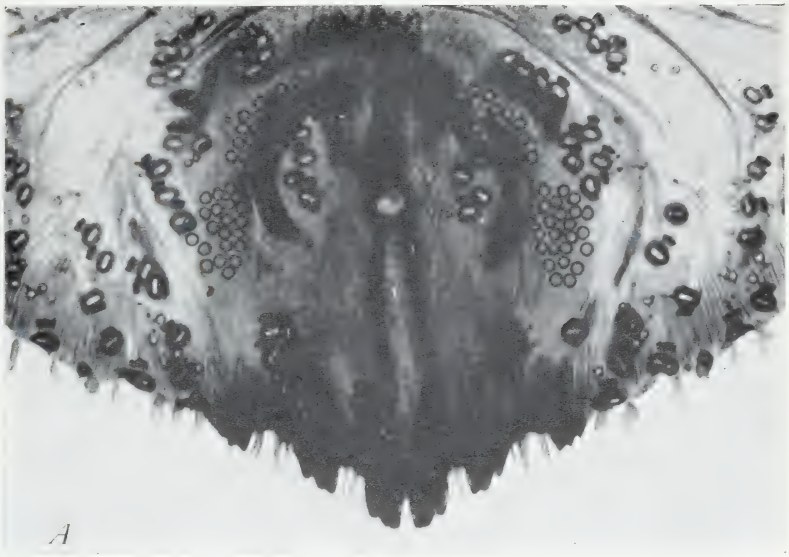
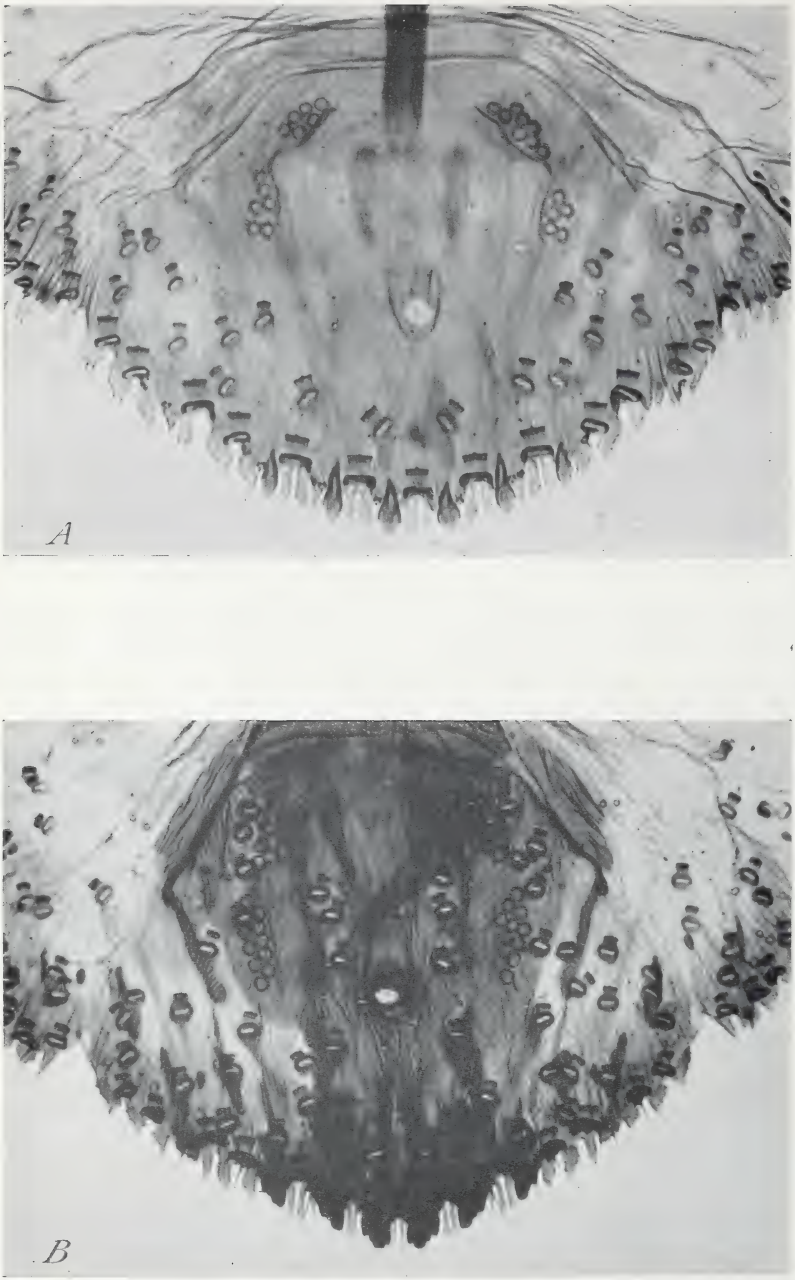
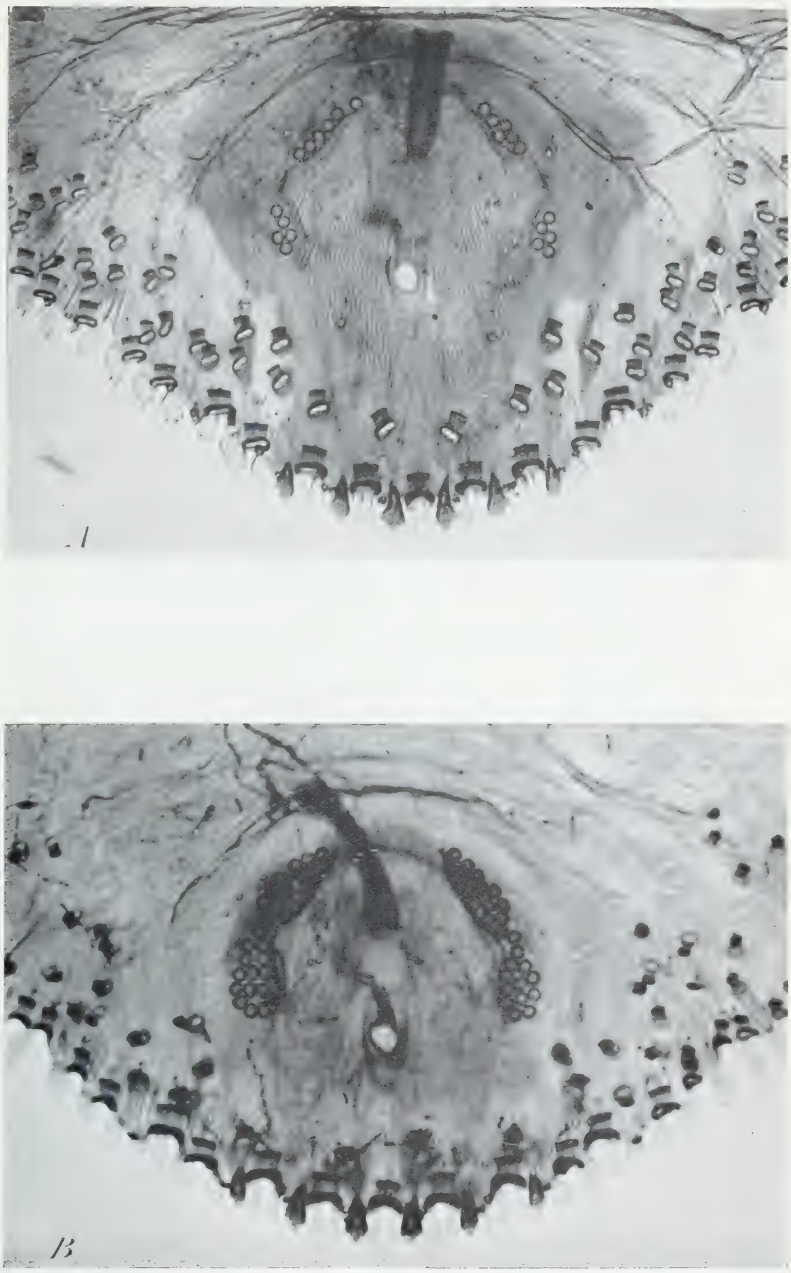


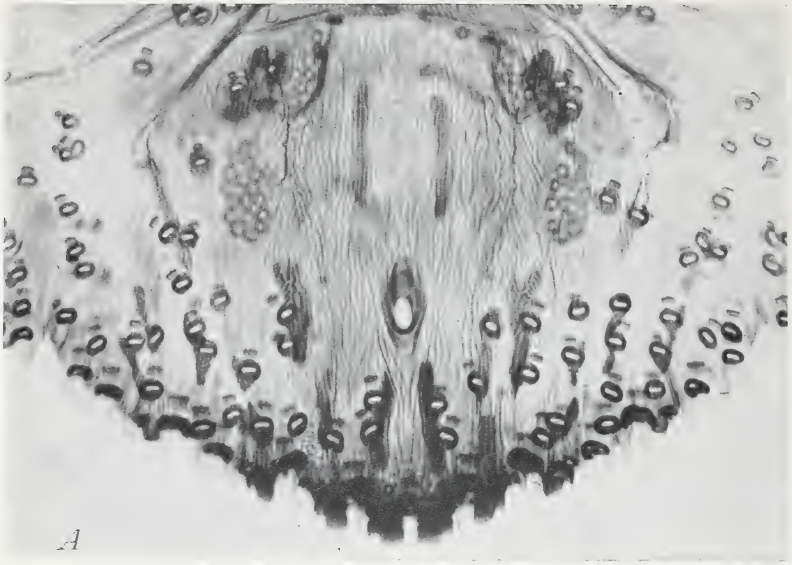
A, Pygidium of *Parlatoria banksiae*, from a specimen on *Banksia integrifolia*, Victoria, Australia, collected by French. *B*, Pygidium of *P. blanchardi*, from a specimen from date palm collected near El Centro, Calif., by Thackery and Shamblin in 1924. × 340.



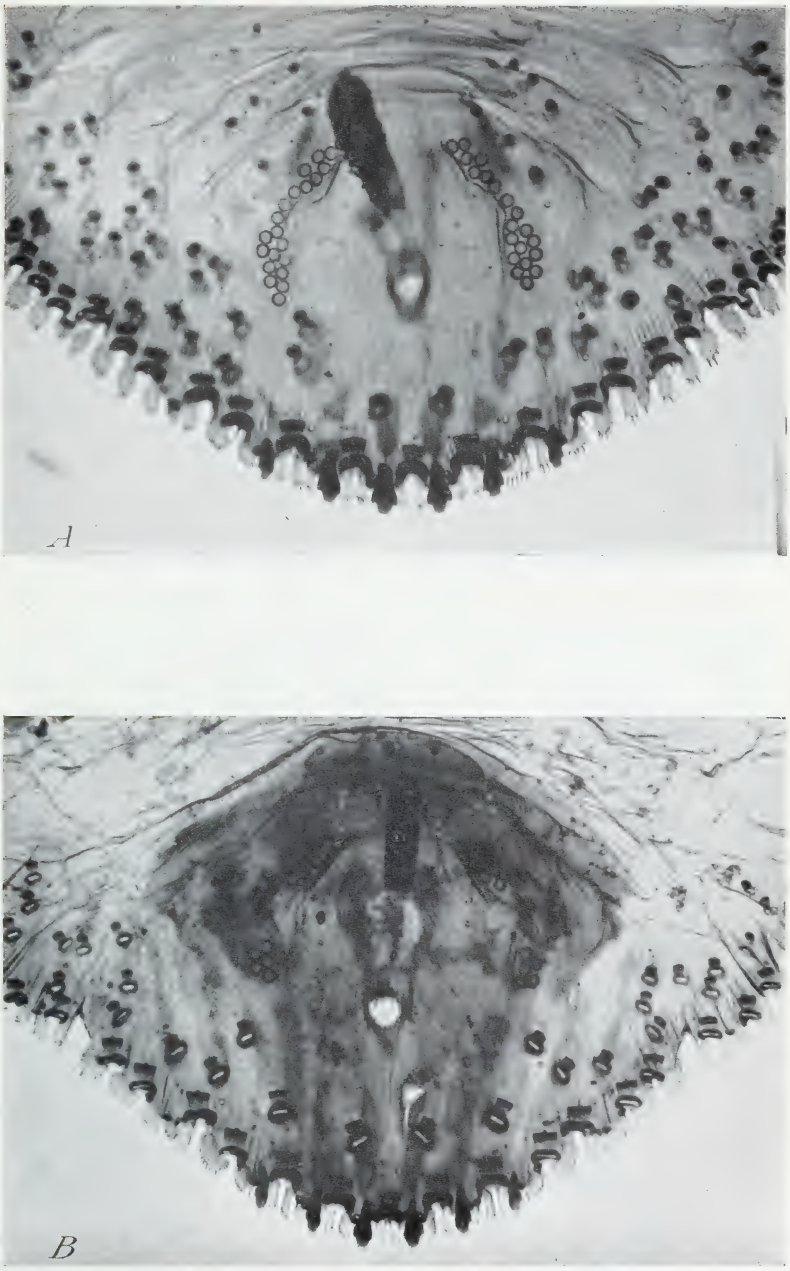
A, Pygidium of *Parlatoria camelliae* from the type specimen, on *Camellia*, U. S. Department of Agriculture greenhouse, Washington, D. C., 1880. Note the double right-hand fourth lobe. *B*, Pygidium of *P. cinerea*, from a specimen on orange from Brazil, collected at quarantine, New York City, by Kostal and Nicaise, 1924. Two of the three dorsal submarginal sclerotic flecks may be seen. × 340.



A, Pygidium of *Parlatoria crotonis*, from a specimen on croton from St. Vincent, West Indies, collected at quarantine, Boston, by Beauchamp in 1936. *B*, Pygidium of *P. fulleri*, from one of Fuller's type specimens. × 340.

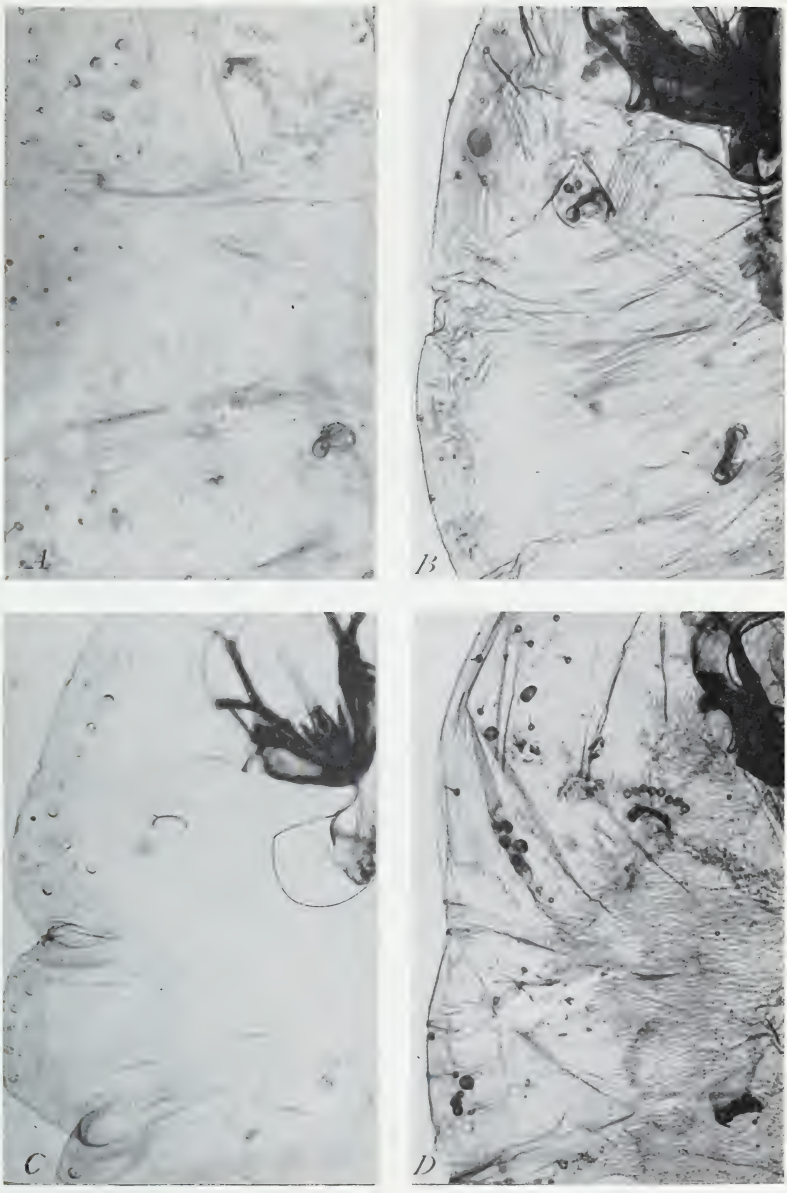


A, Pygidium of *P. oleae*, from a specimen on olive, collected at Tucson, Ariz., by Wehrle in 1933. *B*, Pygidium of *P. pergandii*, from a specimen from lot marked type, and apparently collected on orange at Jacksonville, Fla., by Comstock in 1880. × 340.

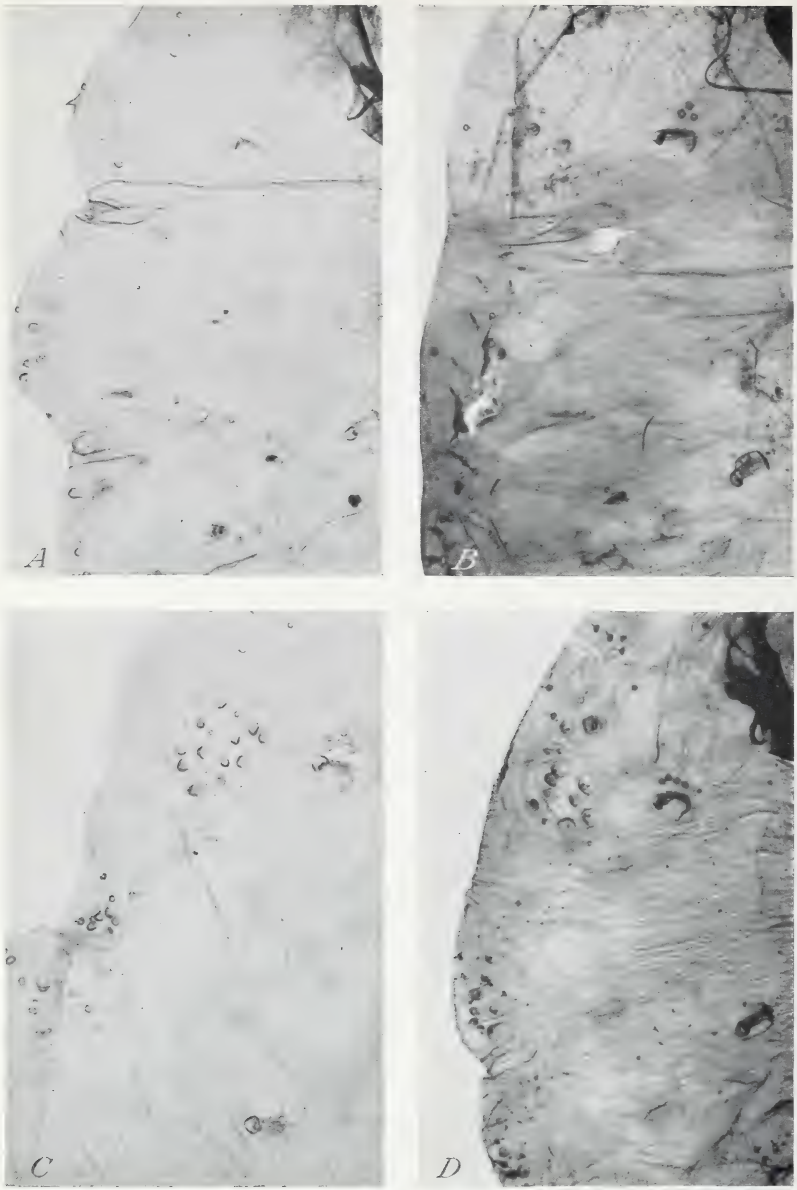


A, Pygidium of *Parlatoria pittospori*, from a specimen on *Pittosporum*, collected at Perth, Western Australia, by George Compere in 1911. The dorsal intermediate macroducts appear as dark spots only. The joined paragenital pore groups of this specimen represent a departure from the characteristic condition. *B*, Pygidium of *P. proteus*, from a specimen on *Vanda tricolor* from the Philippine Islands, collected at Honolulu, Hawaii, by Uyeda in 1934. × 340.

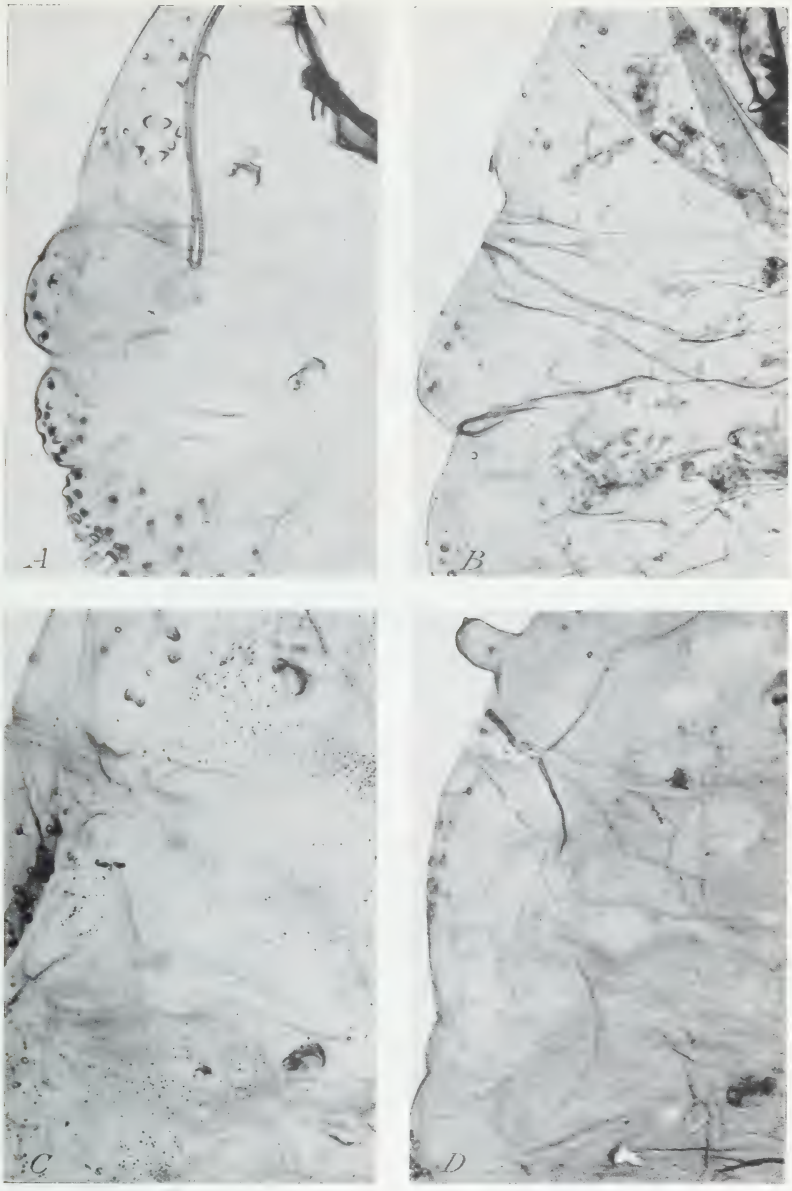
A, Pygidium of *Parlatoria theae*, from a specimen from type material, collected on tea plant in Japan by Takahashi in 1896. The innumerable tiny pigmented dots showing on the derm are not significant and should be ignored. *B*, Pygidium of *P. zizyphus*, from a specimen on lemon from Sicily, collected by Woglum in 1910. × 340.



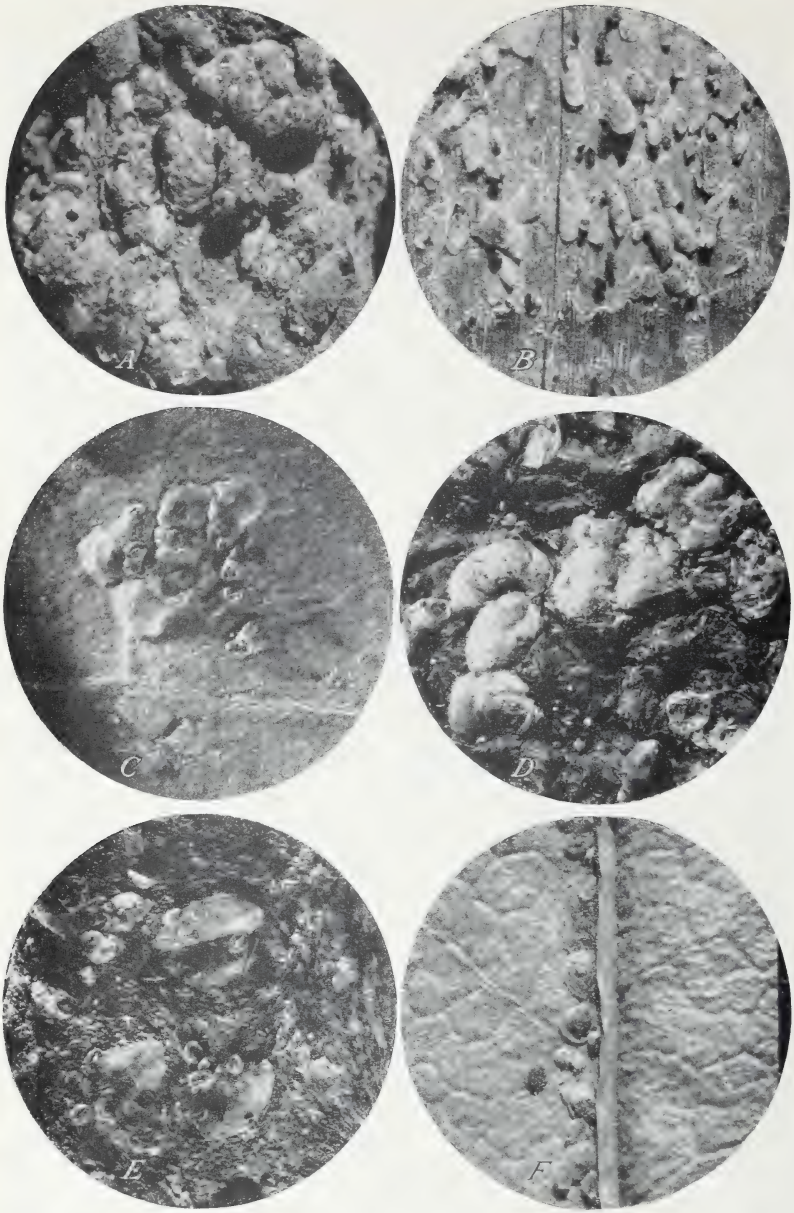
Spiracular-body margin areas: *A*, *Parlatoria banksiae*, showing anterior spiracle with disk pores, anterior spiracular cluster of duct tubercles, eye spot (dark spot at extreme left beyond tubercles), and posterior spiracle and spiracular derm pocket (an irregular dark spot midway between spiracle and inner end of group of tubular ducts). *B*, *P. blanchardi*, showing anterior spiracles with disk pores, large and conspicuous eye spot, posterior spiracle and absence of derm pocket near posterior spiracle, and of duct tubercles. *C*, *P. camelliae*, showing anterior spiracles with disk pores, prespiracular, anterior spiracular, and intermediate duct tubercle clusters, posterior spiracle, and derm pocket (an irregular dark spot below posterior spiracle and towards margin). *D*, *P. cinerea*, showing anterior spiracle with disk pores, prespiracular, anterior spiracular, and intermediate tubular duck clusters, posterior spiracle, and absence of associated derm pocket. All from same specimens listed in explanations of plates 1 and 2. × 245.



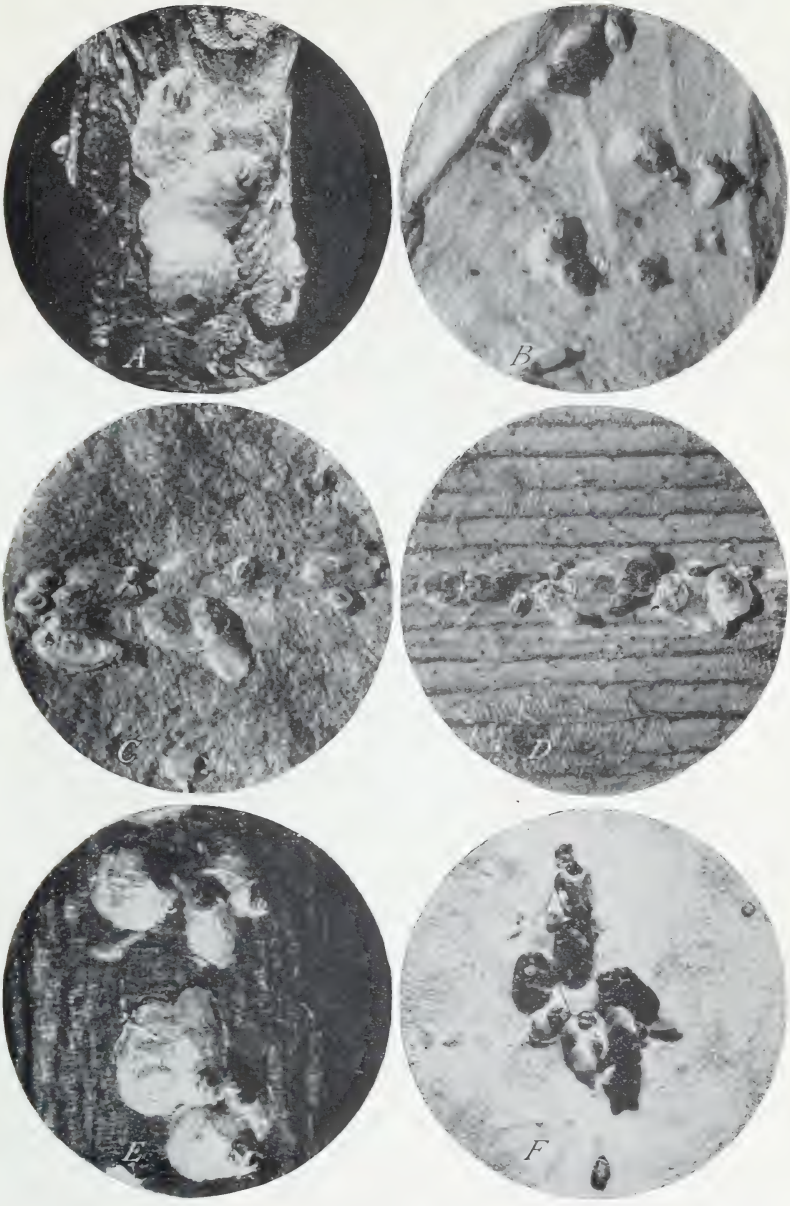
Spiracular-body margin areas: *A*, *Parlatoria crotonis*, showing anterior spiracle with disk pores, small circular cicatrix about halfway to margin, protruding marginal spur, prespiracular, anterior spiracular, intermediate, and posterior spiracular tubular duct clusters, posterior spiracle, and associated derm pocket (irregular black spot almost opposite spiracle, and about one-fourth distance to body margin). *B*, *P. fulleri*, showing anterior spiracle, with disk pores, prespiracular, anterior spiracular, intermediate, and portion of posterior spiracular duct tubercle clusters, posterior spiracle, and associated derm pocket (as an irregular dark spot opposite spiracle and about two-fifths distance to body margin). *C*, *P. oleae*, showing anterior spiracle with disk pores, prespiracular, anterior spiracular, intermediate, and portion of posterior spiracular duct tubercle clusters, posterior spiracle, and absence of associated derm pocket. *D*, *P. pergandii*, showing anterior spiracle with disk pores, prespiracular, anterior spiracular, intermediate, and portion of posterior spiracular duct tubercles, posterior spiracle, with associated small tubular ducts, and absence of derm pocket. All from same specimens listed in explanations of plates 3 and 4. × 245.



Spiracular-body margin areas: *A, Parlatoria pittospori*, showing anterior spiracle with disk pores, all duct tubercle clusters, posterior spiracle, and absence of associated derm pocket. *B, P. proteus*, showing anterior spiracle with disk pores, marginal spur, prespiracular, anterior spiracular, intermediate, and portion of posterior spiracular duct tubercle groups, posterior spiracle, and associated derm pocket (small irregularly elongate black spot on lower edge of broken area, almost halfway to body margin). *C, P. theae,* showing anterior spiracle with disk pores, anterior spiracular and intermediate duct tubercle clusters, eyespot (diffused, out-of-focus, round spot on margin opposite anterior spiracle), posterior spiracle and associated derm pocket (relatively conspicuous, irregular black spot at left of posterior spiracle). *D, P. zizyphus*, showing portion of anterior spiracle and one disk pore, enlarged marginal protuberance with large eyespot at its apex, intermediate duct tubercles (out of focus), posterior spiracle, and absence of associated derm pocket. All from same specimens listed in explanations of plates 5 and 6. × 245.



A, *Parlatoria banksiae*, massed female and male scales on twig of *Banksia integrifolia*, from Victoria, Australia, collected by French. *B*, *P. blanchardi* mature and early adult female scales, exposed adult females, and male scales on date palm leaf from ranch near El Centro, Calif., collected by Thackery and Shamblin, January 1924. *C*, *P. camelliae*, mature and early adult female and male scales on leaf of *Camellia japonica* from Augusta, Ga., collected by Gladys Bruckner, 1933. *D*, *P. cinerea*, mature female scales on orange peel from Brazil, collected at Quarantine, New York City, by Kostal and Nicaise, 1924. *E*, *P. crotonis*, mature and early adult female and male scales on leaf of croton from Garfield Park, Chicago, Ill., collected by Sanders, 1933. *F*, *P. fulleri*, early adult female scales from type material of Fuller's *viridis*. × 9.5.



A, *Parlatoria oleae*, mature adult female scales on almond twig from Italy, collected at quarantine, Philadelphia, Pa., by Harley, 1928. *B*, *P. pergandii*, mature female and male scales on orange leaf from material marked "type" and presumably collected at Jacksonville, Fla., by Comstock, 1880. *C*, *P. pittospori*, mature and early adult female and male scales on leaf of *Pittosporum* species from Melbourne, Australia, collected by George Compere. *D*, *P. proteus*, mature and early adult female and male scales on leaf of orchid (*Dendrobium* sp.), collected in greenhouse at Yonkers, N. Y., after importation from England, by Fields, 1931. *E*. *P. theae*, mature adult female scales on twig of maple, from Japan, collected by Kuwana in 1924. *F*, *P. zizyphus*, mature and early adult female and male scales, one exposed adult female, on lemon leaf, from Palmero, Sicily, collected by Woglum in 1910. × 9.5.

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U. S. GOVERNMENT PRINTING OFFICE: 1939

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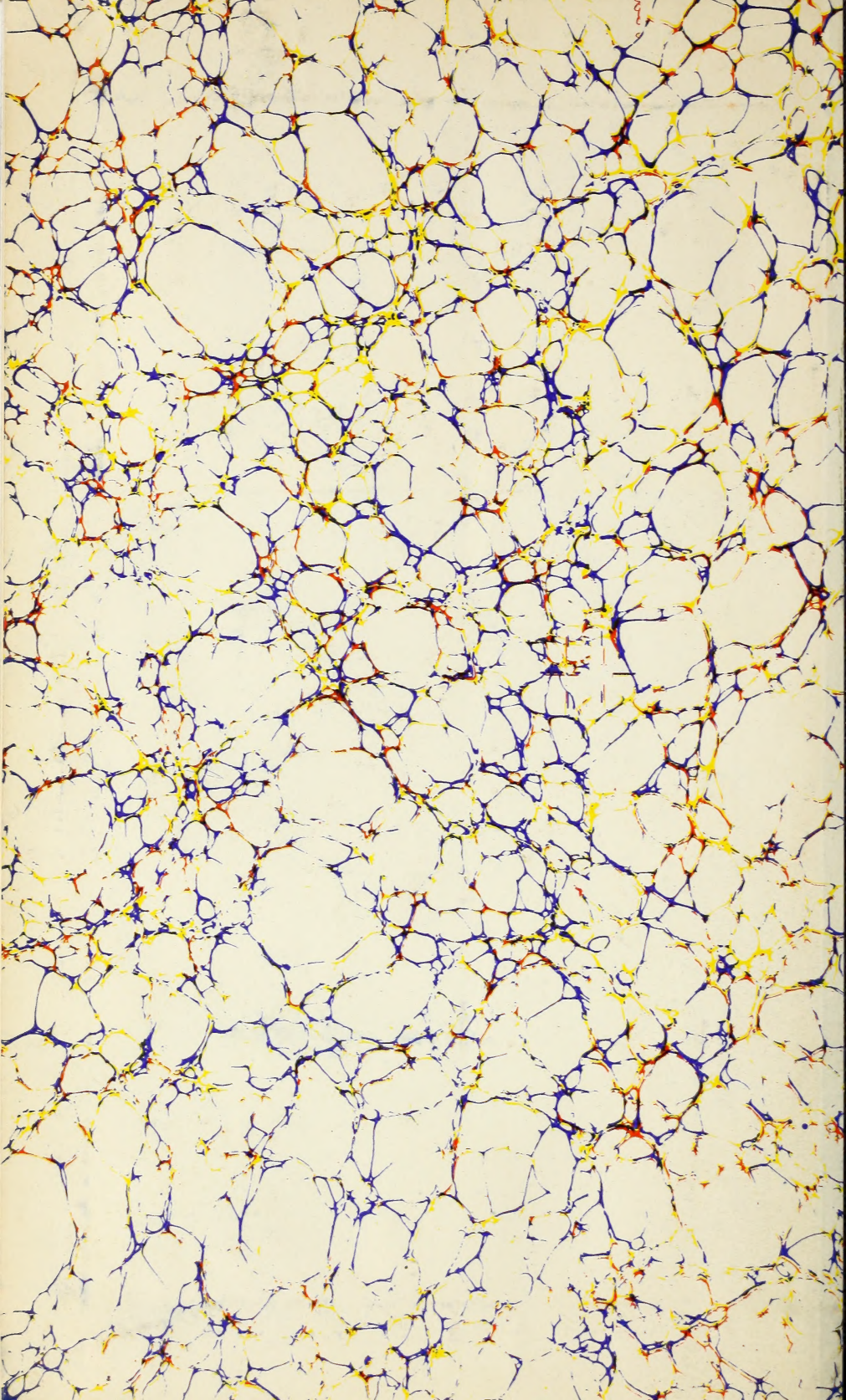

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